

MOSQUITO STUDIES (Diptera, Culicidae)

XXXIII. A REVISION OF THE SCAPULARIS GROUP

OF AEDES (OCHLEROTATUS)<sup>1</sup>

By

J. Hal Arnell<sup>2</sup>

CONTENTS

INTRODUCTION . . . . .	2
MATERIAL AND METHODS . . . . .	3
SYSTEMATICS . . . . .	4
Taxonomic History . . . . .	4
Taxonomic Characters . . . . .	4
Proposed Classification . . . . .	6
Distribution . . . . .	6
Affinities . . . . .	6
MEDICAL IMPORTANCE . . . . .	7
TAXONOMIC TREATMENT . . . . .	9
Scapularis Group . . . . .	9
Keys to Subgroups and Species . . . . .	15
Incomptus Subgroup . . . . .	20
1. <i>Aedes (O.) incomptus</i> . . . . .	20
Bogotanus Subgroup . . . . .	22
2. <i>Aedes (O.) bogotanus</i> . . . . .	22
3. <i>Aedes (O.) deficiens</i> . . . . .	24
Trivittatus Subgroup . . . . .	25
4. <i>Aedes (O.) atactavittatus</i> . . . . .	26
5. <i>Aedes (O.) meprai</i> . . . . .	28
6. <i>Aedes (O.) angustivittatus</i> . . . . .	29
7. <i>Aedes (O.) trivittatus</i> . . . . .	35
Tortilis Subgroup . . . . .	38
8. <i>Aedes (O.) tortilis</i> . . . . .	39
9. <i>Aedes (O.) auratus</i> . . . . .	44

---

<sup>1</sup>Contribution from project "Mosquitoes of Middle America" supported by U.S. Public Health Service Research Grant AI-04379 and U.S. Army Medical Research and Development Command Research Contract DA-49-193-MD-2478.

<sup>2</sup>Department of Biology, University of California, Los Angeles, CA 90024.



Infirmatus Subgroup . . . . . 46

10. *Aedes (O.) condolezens* . . . . . 46

11. *Aedes (O.) euplocamus* . . . . . 48

12. *Aedes (O.) patersoni* . . . . . 50

13. *Aedes (O.) raymondi* . . . . . 52

14. *Aedes (O.) infirmatus* . . . . . 53

Scapularis Subgroup . . . . . 55

15. *Aedes (O.) phaeonotus* . . . . . 56

16. *Aedes (O.) scapularis* . . . . . 57

17. *Aedes (O.) comitatus* . . . . . 66

Crinifer Subgroup . . . . . 67

18. *Aedes (O.) crinifer* . . . . . 68

19. *Aedes (O.) synchytus* . . . . . 71

Obturbator Subgroup . . . . . 72

20. *Aedes (O.) obturbator* . . . . . 72

Pectinatus Subgroup . . . . . 74

21. *Aedes (O.) pectinatus* . . . . . 74

Thelcter Subgroup . . . . . 76

22. *Aedes (O.) thelcter* . . . . . 76

Subgroup unknown . . . . . 78

23. *Aedes (O.)* sp., Surinam form . . . . . 78

24. *Aedes (O.)* sp., Colombian form . . . . . 79

REFERENCES CITED . . . . . 80

FIGURES . . . . . 90

TABLE OF DISTRIBUTIONS . . . . . 140

CONSPECTUS OF TAXONOMIC CHANGES . . . . . 142

INDEX TO SCIENTIFIC NAMES . . . . . 143

INTRODUCTION

The species of the Scapularis Group constitute one of the main evolutionary lines of the subgenus *Ochlerotatus* in the New World. Several phyletic lines of Neotropical ground pool breeding *Aedes* exhibit strong similarities in one or more stages, and it is often difficult to define these evolutionary lines when considering less than all stages together. As a result, the classification of Neotropical *Ochlerotatus* is unquestionably confused and the present revision is an initial attempt to bring order to this area of mosquito taxonomy. It is appropriate to begin with the species of the Scapularis Group since *scapularis* itself is the type of the subgenus *Ochlerotatus*. It is hoped that this study might stimulate further revisions of *Ochlerotatus*, even in the New World a large and heterogeneous group.

Dyar (1918a:77) recognized the similarities among many of the species of the Scapularis Group, but since Dyar (1928) and Edwards (1932) no attempt has been made to define the limits of the group or to refine its internal classification. As is true with other Neotropical *Ochlerotatus*, the species of the Scapularis Group are very similar in most stages, and often only careful comparison of females, male genitalia and larvae provides sufficient characters for adequate identification of species. Because this has not always been done, the taxonomic literature is replete with misinterpretations of species, misidentifications and erroneous distributions. Due to lack of material in some cases, I have been unable to follow the preferred practice



of comparison of adequate material of all stages and several species interpretations are provisional. Only collection and study of more material will confirm or refute these interpretations.

Several species of the Scapularis Group have been implicated in disease transmission to man or his domestic animals and in view of the widespread distribution and broad ecological tolerances of these species a thorough knowledge of their taxonomy should aid in disease control.

I wish to thank John N. Belkin for reading and criticizing the manuscript and for discussions on several aspects of the study; Thomas J. Zavortink for stimulative discussion of the study; Peter F. Mattingly for the loan of specimens from the British Museum (Natural History); Miguel Garcia for the loan of specimens from the Instituto Nacional de Microbiologia, Buenos Aires; John F. Reinert for the loan of specimens from his personal collection; L. T. Nielsen for the loan of specimens from the University of Utah; Curtis W. Sabrosky and Ronald A. Ward for kindnesses extended during my visit to the U.S. National Museum and for arranging the loan and return of specimens from the USNM; William A. Powder and Sandra J. Heinemann for the preparation of material; L. Margaret Kowalczyk and Nobuko Kitamura for the preparation of the preliminary and final drawings; and Kay Metzner for typing the rough draft and preparing the text copy for lithoprinting.

## MATERIAL AND METHODS

The material for this study came primarily from collections made for the project "Mosquitoes of Middle America" (Belkin, Schick et al., 1965) and is deposited at the University of California, Los Angeles [UCLA]. Additional specimens were borrowed from or examined at the U.S. National Museum of Natural History [USNM], including the holotypes of *angustivittatus*, *trivittatus*, *bracteatus*, *balteatus*, *plutocraticus*, *virginensis*, *condolenscens*, *indolenscens*, *obturbator* and *thelcter* and the lectotypes of *cuneatus*, *argentescens*, *traversus*, *inconspicuus*, *habanicus*, *auratus* and *camposanus*; the British Museum (Natural History) [BM], including the lectotypes of *tortilis* and *crinifer*; the Instituto Nacional de Microbiologia, Buenos Aires, Argentina [INM], including the holotype of *raymondi*; the Department of Biology, University of Utah [UTAH]; and John F. Reinert, Laurel, MD [JFR]. A total of 12,214 specimens was examined, 1787 males, 6280 females, 1911 pupae and 2236 larvae. Included in this total were 859 individual rearings of which 458 were larval rearings, 331 were pupal rearings and 70 were incomplete.

The procedures used in this study were primarily those of comparative morphological taxonomy. The form of presentation and terminology and abbreviations used in the descriptions follow Belkin (1962) with modifications (Knight, 1970; Knight and Laffoon, 1970, 1971; Laffoon and Knight, 1971). Descriptions are composites of all available specimens. In 4 instances only a single specimen was available. Illustrations were prepared in general from a single specimen but were corrected to show the modal condition of most available specimens. On the maps, localities from which I examined specimens are indicated by solid symbols and records from the literature by hatched symbols. Political subdivisions and locality names in the distribution lists conform to the recommended usage in the Official Standard Names Gazeteers of the United States Board on Geographic Names.



## SYSTEMATICS

**TAXONOMIC HISTORY.** *Culex scapularis* was described by Rondani in 1848 and *Ochlerotatus confirmatus*, conspecific with *scapularis*, was described by Lynch Arribalzaga in 1891. By 1910, 21 species now included in the Scapularis Group had been named, although their close relationship had not been recognized. In the final edition of his monograph on the Culicidae, Theobald (1910) placed the species known to him in 3 genera, *trivittatus* in *Pseudohowardina*, *scapularis* in *Leucomyia* and *crinifer* and *inconspicuus* (conspecific with *trivittatus*) in *Culex*. H. G. Dyar was apparently the first to recognize the similarities among the species. In their monograph, Howard, Dyar and Knab (1917:770-810) placed the species generally together, and in a paper on natural mosquito groups based on male genitalic structures, Dyar (1918a:77) placed *scapularis*, *infirmatus*, *euplocamus*, *tortilis*, *pluto-craticus*, *trivittatus*, *cuneatus*, *condolenscens*, *balteatus*, *bracteatus*, *angustivittatus* and *obturbator*, the latter 5 being unknown to him in the male, together under one couplet in Group IV, *Ochlerotatus*, forms with a well developed claspette (harpago) and basal and apical sidepiece lobes, in his key. Dyar (1920:103-106) later combined his Groups IV and V (*Ochlerotatus* and *Culicada*) under the subgenus *Heteronycha* Lynch Arribalzaga (the name later restricted to *Culex*), and included all forms with both basal and apical lobes. Under *Heteronycha* was the "Group *scapularis*," those forms he had placed together in his previous paper, this being the first use of the Scapularis Group designation. In subsequent works, Dyar (1922a:51-60; 1924a:117-119; 1928:162-170) refined the subgeneric placement and his concept of the species included in the group. In the most recent treatment of the Scapularis Group, as such, Edwards (1932:137, 142-143) broadened the group to include also *dupreei* (Coq., 1904) and related species, *serratus* (Theo., 1901) and related species, *euiris* Dyar, 1922 and *hortator* Dyar & Knab, 1907.

Coquillett (1910:577) designated *confirmatus*, the second of 2 species included by Lynch Arribalzaga (1891:146) in his genus *Ochlerotatus*, as the type of the genus. This nominal species is now considered to be a subjective synonym of *Aedes scapularis*.

**TAXONOMIC CHARACTERS.** The Scapularis Group, including the subgroups within it, is defined primarily on the basis of adult characters, especially those of the female. The immature stages and the male genitalia display a mosaic of characters which make phylogenetic relationships difficult to determine in most cases. Although the male is much like the female except for sexual differences, the distribution of scales and patterns of scale colors which constitute the most obvious and reliable taxonomic characters are more conspicuous and constant in the female than in the male.

**Female characters.** The scales covering the scutum except for the usual bare spaces are narrow and curved and range in color from dark brown to white. The color pattern formed by these scales is the most important taxonomic character in the Scapularis Group not only in identifying species but also in defining the subgroups. The presence or absence of white scales on the apices of the femora, most conspicuous when present on the ventral surface of the midfemur and hindfemur often are significant in species recognition, and even though all species have basolateral white scale patches on the abdominal terga, white scales often extend across the dorsal surface at the base of the terga and their presence or absence is significant. The Scapularis Subgroup is uniquely marked with white scales in a long stripe on the anterior of the hindtibia, the white scales often continued to the basal tarsal



segments. The development of palpal segment 4 is of minor importance and must be observed on slide-mounted specimens.

**Male genitalic characters.** Considerable confusion has resulted in the past in attempts to separate the species of the Scapularis Group on the basis of the male genitalia. Emphasis has been placed on characters which are not constant, while several reliable characters appear to have been overlooked. The differences in male genitalic characters between many species are relatively minor, and I have found it impossible to separate several of the 19 species which are known to me in the male, among these being several common and widespread species.

Characters which I have found to be of value include sidepiece length, the distribution and development of setae on the tergal and sternomesal surfaces of the sidepiece, the development of the setae on the basal tergomesal lobe of the sidepiece, the claspette and the spiniform of the clasper. Tergite IX, the phallosome and proc-tiger have proven to be of no value. The apical tergomesal lobe of the sidepiece, a character on which considerable importance has been placed in many studies of *Ochlerotatus*, is undeveloped to well developed in the Scapularis Group and appears to be of little phylogenetic significance. The taxonomic value of this structure is further diminished by variation in orientation of the sidepiece in slide preparations.

The subapicotergal setae consist of an irregular, usually oblique, row of 2 to 8, usually 4 to 6, very well developed setae on the middle of the tergal surface of the sidepiece at about the level of the base of the apical tergomesal lobe. The setae proximad of the subapicotergal setae are significantly weaker in development, and may be separated from the subapicotergal setae by a bare space, and are either uniformly short or progressively longer distally. Immediately ventrad of the mesal membranous surface of the sidepiece is a sclerotized area, often separated from the sternal surface by a narrow membranous area, extending from the level of the basal tergomesal lobe to about the base of the clasper, from which arise about 20 to 80 long to very long setae, the number and development of which are relatively constant within a species. The basal tergomesal lobe is well developed, triangular, though often folded ventrad in slide preparations thus appearing deceptively small. About 10 to 30 setae arise from the lobe with the peripheral setae of the cluster usually being slightly longer and with a single basal seta being much longer and thicker than the remainder. This differentiated seta is thickened basad of the middle and tapers gradually to a usually recurved apex. The size of this seta appears to be constant for each species, although accurately assessing the thickness and length is too difficult for this character to be of practical value. The claspette has a characteristic development in many species and is important in species determination, although to be of value it must be separated from the remainder of the genitalia and mounted in a lateral view. The ratio of spiniform length to width is significant in a few species. Measurements were made at a magnification of 860 diameters.

**Pupal characters.** The pupae of the Scapularis Group are remarkably uniform in structure and for the most part are difficult or impossible to recognize to species. I have not found any species or subgroup characters sufficiently reliable or of sufficient magnitude to allow preparation of a key. However, there are several characters that differ somewhat from species to species and since they are of some value they are included in the species descriptions.

**Larval characters.** The thoracic and abdominal integument of all species of the Scapularis Group is spiculose. There is very little intraspecific variation in spicule density or length, and, although somewhat inconvenient to use, in several instances this character is important in species diagnoses. Spicules were measured on slide-



mounted larvae or larval skins, under a magnification of 860 diameters. The relatively broad spicule base tapers abruptly to a needle-like shaft and the ratio of basal width to spicule length was measured using an ocular grid on spicules entirely within the plane of the microscope field.

**PROPOSED CLASSIFICATION.** The present revision of the Scapularis Group of *Aedes* (*Ochlerotatus*) treats 22 species and 2 unnamed forms. Of the 22 species, 8 are new and 1 has been resurrected from synonymy. In addition, 3 names, *hemisurus*, *camposanus* and *rhyacophilus*, have been reduced to the synonymy of *scapularis*. Ten subgroups are recognized within the Scapularis Group in the present revision. They are characterized primarily by unique or unusual features of the adult female but often have distinctive features in other stages. The subgroups are summarized below.

**Incomptus Subgroup.** Monotypic. Male and female scutum completely dark brown scaled.

**Bogotanus Subgroup.** 2 species. Female scutum dark brown scaled with a narrow acrostichal line of white scales.

**Trivittatus Subgroup.** 4 species. Female scutum with narrow to broad dorso-central lines of light scales extending the entire length of the scutum; pleural integument dark brown.

**Tortilis Subgroup.** 2 species. Female scutum with large anterior scutal scale patch of golden to tan scales and very small subspiracular scale patch.

**Infirmatus Subgroup.** 5 species. Female scutum with broad anterior stripe of silvery white scales.

**Scapularis Subgroup.** 3 species. Female scutum with large anterior hexagonal patch of yellowish tan to white scales; anterior surface of hindtibia with white scales.

**Crinifer Subgroup.** 2 species. Female scutum with narrow acrostichal and dorso-central lines of tan to white scales or white and dark brown scales in random pattern; distinctive male genitalia; larva with accessory dorsolateral setae on siphon.

**Obturbator Subgroup.** Monotypic. Scutum with pale tan scales except for dark brown scales in narrow acrostichal line and on lateral scutal margin; pleural integuments light brown; larval siphon with ventroapical prolongation.

**Pectinatus Subgroup.** Monotypic. Female scutum completely dark brown scaled; male scutum with broad patch of white scales on posterior half; larva with 60-70 comb scales; pecten extending well beyond insertion of seta 1-S.

**Thelcter Subgroup.** Monotypic. Scutum yellowish white scaled with usual broad acrostichal line of tan to golden scales; sidepiece of male genitalia short and broad; larval pecten extending beyond insertion of seta 1-S.

**DISTRIBUTION.** The Scapularis Group has an extensive distribution throughout the Americas from southern Canada to middle Argentina except for the far western United States and extreme northwestern Mexico and the Pacific slope of the Andes south of Peru (see figs. 1-4).

**AFFINITIES.** Due to lack of knowledge of much of the aedine fauna of the Neotropics, the affinities between the Scapularis Group and other aedine phylads is difficult to determine. It is apparent, also, that before conclusions on relationships among New World faunas can be made, an extensive knowledge of Old World *Ochlerotatus* must be attained. The subgenus *Ochlerotatus* is often considered to be primarily a northern group since it has undergone a tremendous species explosion in the Holarctic; however, it is undoubtedly tropical in origin.

*Aedes shannoni* Vargas & Downs, 1950 from Central Mexico is possibly closely



allied to the Scapularis Group. I have seen males and females of this species. The male genitalia are similar to species of the Scapularis Group; however, the adult ornamentation differs in several respects, most notably in the presence of basal tarsal bands of white scales, a character which may be of no phylogenetic significance. I have seen no immatures of *shannoni*. For the present, I am not including it in the Scapularis Group.

The morphology and ornamentation of the male and female of *calumnior* Belkin, Heinemann & Page, 1970 from Jamaica and possibly the Cayman Islands is remarkably similar to *obturbator*, *calumnior* being virtually indistinguishable from *obturbator*, although the larva of *calumnior* lacks integumental spiculation typical of the Scapularis Group and the male genitalia are completely unlike any other Neotropical *Ochlerotatus*. The remarkable similarity in the adults of the 2 species may be convergence or may indicate hybridization between 2 distinct phyletic lines at some time in the distant past, possibly during a period of geological instability in the Caribbean area.

On the basis of the male genitalia, the Scapularis Group appears to be closely allied to the Neotropical *euiris* Dyar, 1922, *milleri* Dyar, 1922, *scutellalbum* Boshell-Manrique, 1939, and *bejaranoi* Martinez, Carcavallo & Prosen, 1960, species autochthonous, primarily, to the higher elevations of the Andes, although significant differences are apparent in the adults and larvae. On the basis of distribution, a case may be advanced for relationships between these species and the species of the Scapularis Group, *bogotanus*, *deficiens* and *pectinatus*, apparently endemic to the Colombian Andes, although it must be kept in mind that the Andes are a young mountain range and its mosquito fauna is complex and relatively poorly known.

The species of the Serratus Group, which includes the Neotropical *serratus* (Theo., 1901), *nubilus* (Theo., 1903), *pertinax* Grabham, 1906, *eucephalaeus* Dyar, 1918, *oligopistus* Dyar, 1918, *hastatus* Dyar, 1922 and *aenigmaticus* Cerqueira & Costa, 1946, and the Nearctic *dupreei* (Coq., 1904), *atlanticus* Dyar & Knab, 1906 and *tormentor* Dyar & Knab, 1906, resemble the Scapularis Group closely in the female and a close relationship is often advanced. The 2 groups are distinguishable primarily by the absence of subspiracular scales in the Serratus Group, although the individual species can be separated, in most cases, from the Scapularis Group by other details of ornamentation. On the basis of the male genitalia, the Serratus Group differs markedly from other New World *Ochlerotatus*, having an enlarged, thumb-like apical tergomesal lobe and, more importantly, a basal tergomesal lobe either partially detached from the sidepiece or attached to the sidepiece by a membrane and more strongly attached to the claspette. Belkin, Heinemann and Page (1970:160) suggest that this group might be placed in a separate subgenus, the name *Protoculex* Felt, 1904 (type species, *serratus*) being available.

### MEDICAL IMPORTANCE

The medical importance of the Scapularis Group is significant, since five species, *scapularis*, *trivittatus*, *infirmatus*, *thelcter* and *angustivittatus*, have been implicated in the transmission of disease agents. Of the five species, *scapularis* is by far the most important, at least 15 viruses having been isolated from this species including yellow fever and Venezuelan equine encephalitis (VEE) viruses and it also appears to be a vector of Bancroftian filariasis. It should be pointed out, however, as Sudia, Newhouse and Chappell (1969:600) state, a mosquito can be considered no more



than a potential vector of a disease organism unless 4 criteria are met: (1) isolation of the disease producing agent from wild caught specimens, (2) demonstration of its ability to become infected by feeding on an infected host, (3) demonstration of its ability to transmit by bite, and (4) field evidence confirming association of the infected mosquito with the vertebrate population in which the infection is occurring.

DeRodaniche and Galindo (1963:925) report the isolation of Ilheus virus from a pool of 423 *angustivittatus* collected near Almirante, Panama in November, 1960, and an isolation of VEE virus from *angustivittatus* in Colombia is reported by Sanmartin, Mackenzie et al. (1973).

*Aedes thelcter* appears to be one of the more important potential vectors of VEE in the localized areas where this species is common. Sudia and Newhouse (1975:3) report numerous isolates of VEE virus from *thelcter* collected in the lower Rio Grande valley of Texas and Mexico during the epidemic wave of VEE through this area in 1971. During the study of this epidemic, *thelcter* was found to have the highest infection rate for VEE virus among all species collected and tested (Sudia, Newhouse et al., 1975:27).

Although the species does not appear to be particularly important in transmission, several viruses have been isolated from *infirmatus* in the southeastern United States. Lewis, Hammon et al. (1965) and Bond, Hammon et al. (1966) report a California group virus similar to Trivittatus virus, later confirmed to be Trivittatus virus (Wellings, Lewis and Pierce, 1972), recovered frequently and predominantly from *infirmatus* in Florida, although human disease from this source was uncommon. A Trivittatus virus-*infirmatus* cycle was later confirmed by Taylor, Lewis et al. (1971) in Florida in a 1966-1967 study in which Keystone virus, another California group virus, was also isolated from *infirmatus*. In a summary report on arboviral ecological studies in the same area of Florida, Wellings, Lewis and Pierce (1972) report Eastern equine encephalitis, Keystone, Trivittatus and Tensaw virus isolations from *infirmatus*. One isolation of Trivittatus virus from *infirmatus* in southern Alabama is reported by Sudia, Chamberlain and Coleman (1968).

*Aedes trivittatus* is a relatively common mosquito in the midwestern United States, and virus isolations in several eastern and midwestern states show that several viruses are not uncommonly found in this species. Trivittatus virus was originally isolated from *trivittatus* in North Dakota. Kokernot, Hayes et al. (1969) report Trivittatus virus from 5 of 24 pools (649 specimens) of *trivittatus* taken from man and light trap collections in southern Illinois in 1967. A very high infection rate of Jamestown Canyon serotype of California encephalitis virus is reported from *trivittatus* in Wisconsin by DeFoliart, Ainslow et al. (1969), and in a later paper, DeFoliart, Ainslow et al. (1972) report evidence that Trivittatus virus shows a high specificity for *trivittatus*, but since *trivittatus* feeds on a variety of vertebrates there is no indication of the relationship between the virus and its vertebrate hosts. Wong, Dorsey et al. (1970), reporting on surveillance of encephalitis virus in Iowa state that California group viruses appear as clinical cases in children every year and that *trivittatus* is a major cause. This species was the second most abundant mosquito taken in trapping collections from 1966 to 1968, and one isolate of Trivittatus virus was made for every 250 pools tested. Wong, Rowley et al. (1973) report 2 isolations of Western equine encephalitis virus and 1 isolation of Flanders virus, in addition to 29 isolations of Trivittatus virus from *trivittatus* in Iowa in 1969, 1970 and 1971. Wills, Pidcoe et al. (1974) report isolates of Trivittatus virus from *trivittatus* in Pennsylvania. Over 26,000 mosquito specimens were collected in the state of Durango, Mexico in June, 1972, as reported by Sudia, Fernandez et al. (1975) from which 1



isolate of Trivittatus virus and 2 isolates of Bunyamwera virus were made. The mosquitoes were identified as *angustivittatus*, although it is much more likely that the species was actually *trivittatus*. A summary of recent research into the activity of California group arboviruses in the United States and Canada, which contains additional information on the role of *trivittatus*, *infirmatus* and *thelcter*, is presented by Sudia, Newhouse et al. (1971).

*Aedes scapularis*, besides being the most common and widespread species of the Scapularis Group, is also the most important in the transmission of disease. Rachou, Lima et al. (1954, 1955), in conducting an epidemiological survey of a village in southern Brazil for filariasis, concluded that *scapularis* was a principal vector of Bancroftian filariasis outdoors because of its abundance and demonstrated vector capability. Of 39 individuals captured and dissected, 1 was in infective and 2 in preinfective stages.

*Aedes scapularis* has been shown to be an efficient vector of yellow fever virus under experimental conditions (Davis and Shannon, 1929:803; Whitman and Antunes, 1937:810-811; Shannon, Whitman and Franca, 1938:110). Soper, Penna et al. (1933) opined that *scapularis* may well have been a vector of yellow fever during an outbreak in Espirito Santo, Brazil, and Bugher, Boshell-Maurique et al. (1944) report the possible implication of *scapularis* in yellow fever transmission in eastern Colombia. Forattini (1961) has shown that *scapularis* is apparently becoming domesticated in areas where it has had a long association with man, and since it is an efficient vector of yellow fever virus, it has a high potential as a vector of urban yellow fever.

Venezuelan equine encephalitis has been isolated from *scapularis* in the Amazon region of Brazil (Causey, Causey et al., 1961:242), Cumana, Venezuela (Sellers, Bergold et al., 1965), Veracruz, Mexico (Scherer, Dickerman et al., 1971), although VEE apparently has multiple vectors in that region, and Ecuador (Gutierrez, Monath et al. as reported by Sudia and Newhouse, 1975:12).

Many other arboviruses whose disease threat to man or his domestic animals is either unknown or negligible have been isolated from *scapularis*. These include Mayaro virus from Trinidad (Aitken, 1957:231); Manzanilla virus from Trinidad (Anderson, Spence et al., 1960), although the virus was not transmitted by bite by infected *scapularis*; Kairi virus from Trinidad (Anderson, Aitken et al., 1960; Causey, Causey et al., 1961), with antibodies found in humans and several animal species; Caraparu virus from Trinidad (Causey, Causey et al., 1961) isolated from a mixed pool of *scapularis*, *Aedes serratus*, and *Sabethes* species; Cache Valley virus from Trinidad (Downs, Spence et al., 1961); Melao virus, the original isolation of this California group virus being from *scapularis* from Trinidad (Spence, Anderson et al., 1961); a California group virus, TR9375, from Trinidad (Aitken, 1960; Causey, Causey et al., 1961) and from Brazil (Causey, Causey et al., 1961); the Brazilian strain of Ilheus virus, TR8349 virus, TR8900 virus, TR10076 virus, and TR20659 virus, all from Trinidad (Aitken, 1960).

## TAXONOMIC TREATMENT

### Scapularis Group

**FEMALES.** Small to medium sized species; integument light brown to dark brown; dark scales with slight iridescence; light scales exclusive of scutum white to



gray, on scutum silvery white to yellow or gold; pleural scale patches reduced.

**Head:** Integument usually dark brown. Eyes moderately separated above antennae, interocular space of 1-3 ommatidial diameters, with narrow, curved scales. Decumbent scales of vertex and occiput narrow and curved near midline and along ocular border, broad and flat on dorsolateral, lateral, and ventral surfaces; white but usually with small dark patch dorsolaterally. Erect scales moderately numerous to numerous, usually confined to occiput but occasionally extending forward on vertex; mostly white, occasionally dark dorsolaterally and rarely entirely dark. Interocular setae well developed, 1-3 pairs; ocular setae well developed, about 4-6 pairs dorsally, 3-4 pairs laterally. Clypeus dark brown, moderately large, bare. Proboscis long, about 1.25-1.60 of forefemur, entirely dark scaled or noticeably lighter ventrally. Palpus short, about 0.16-0.23 of proboscis; 3 or 4 segmented, segment 4 small to minute when present; entirely dark scaled. Antenna slightly shorter than proboscis; pedicel with yellow integument, darker mesally, without scales or with few dark scales mesally; flagellar segment 1 longer than segment 2, with few small scales; flagellar segments 3-13 each slightly longer than preceding segment; segments 2-13 each with basal whorl of 6 moderate setae.

**Thorax:** Integument light brown to dark brown. Acrostichal setae well developed in complete row, partially developed and confined to anterior and posterior of acrostichal line, or restricted to anterior promontory; dorsocentral setae well developed in complete row, or with anterior setae absent except on promontory; prescutellar and supraalar setae numerous and well developed; humeral setae and posterior fossal setae well developed or absent. Scutellum with about 6-15 strong setae on midlobe and lateral lobes. Scutum completely covered with narrow, curved scales except for inner dorsocentral and median and lateral prescutellar bare spaces; scales entirely light, entirely dark, dark with large patches of lighter scales, or with contrasting longitudinal lines of light and dark scales. Scutellum with numerous narrow, curved white and/or dark scales on median lobe, scales sparse or absent on lateral lobes. Postnotum dark brown, bare. Paratergite bare. *Apn* not enlarged. Pleural setae on *apn*, *ppn*, *ppl*, *psp*, *stp*, *pra* and upper *mep*; setae absent on *ssp* and lower *mep*; *ppn* setae in single row near posterior margin; *stp* setae in single row from upper anterior margin of sclerite to near level of lower margin of meron. *Apn* with few narrow, curved, white or dark scales, not closely appressed; *ppn* nearly covered with closely appressed, narrow and curved to broad and flat scales, mostly dark but often white posteroventrally; broad, white, flat, appressed scales in patches on *ppl*, *pst*, *ssp*, *stp* below *pra*, *stp* caudad of *ssp*, *stp* cephalodorsad of midcoxa, *mep* from upper setae to ventral third of sclerite, and usually on *psp*; scales absent on *pcx*, hypostigma and metameron.

**Legs:** Hindcoxa subequal to midcoxa, its base below upper margin of meron. Legs relatively short, forefemur about 0.85-1.05 (rarely up to 1.25) of distance from top of thorax to apex of midcoxa. Forecoxa with white or white and dark scales, midcoxa and hindcoxa with white scales. Forefemur and midfemur generally dark scaled on dorsal and anterior surfaces and white scaled on ventral and posterior surfaces, often white scaling expanded basally and restricted apically; hindfemur mostly white scaled with dorsal dark line beginning at about middle and broadening distally. White posterior knee spots present or absent, when present usually most conspicuous on mid and hind femora. Foretibia and midtibia dark scaled, usually with faint to conspicuous light streak posteriorly. Hindtibia dark scaled, usually with faint light streaks posteriorly, or, in Scapularis Subgroup, basal fourth to apical sixth with conspicuous white stripe on anterior surface which occasionally nearly



encircles segment. Tarsi dark scaled, usually with faint to conspicuous light streak posteriorly on segments 1 to 2 or 3, with additional white streak on anterior surface of segment 1 in Scapularis Subgroup. Claws of foreleg and midleg with acute submedian tooth, or rarely with posterior claw of foreleg and midleg simple; claws of hindleg simple or with acute submedian tooth.

**Wing:** Scales entirely dark or with small patch of white scales at extreme base of costa and remigium. Plume scales on  $R_1$ ,  $R_s$ ,  $R_{2+3}$ ,  $R_2$ ,  $R_3$ ,  $R_{4+5}$ , and ventrally on  $M_{1+2}$ ,  $M_{3+4}$ ,  $Cu$  distad of *m-cu*, and distally on 1A.

**Haltere:** Knob light or dark scaled.

**Abdomen:** Tergum I dark scaled dorsally, bare laterally. Terga II-VII with basolateral white scale patches, remainder of terga dark scaled but often with narrow basal white bands or basomedian white patches. Sterna mostly white scaled.

**FEMALE GENITALIA. Segment VIII:** Completely or nearly completely retracted into segment VII. Tergum narrowed distally; on midline about 0.5-0.6 of tergum VII; distal 0.85 with sparse, short setae becoming more dense distally and rarely a few scales. Sternum about 1.05-1.30 of tergum VIII; broader distally; distal margin broadly rounded and uniformly sclerotized, or slightly emarginate and more weakly sclerotized on midline; with sparse, short setae and few longer setae over entire surface, more numerous distally; usually few scales on lateral and distal margins. **Tergum IX:** Notched distally, maximum length about 0.35-0.50 of tergum VIII; moderately sclerotized; lobes with 3-8 weakly developed setae. **Insula:** Weakly sclerotized; connected to lower vaginal lip; with a pair of setae on each side of midline. **Cercus:** Long, about 0.75-1.05 of tergum VIII; apex rounded; setae numerous, the longest moderately developed; scales absent. **Postgenital Plate:** Short and broad, length 0.35-0.55 of tergum VIII; index about 1.35-1.75; apex slightly emarginate in ventral aspect; 6-8 weakly developed setae and 2 moderately developed seta distally; basal median longitudinal apodeme weakly developed. **Upper Vaginal Lip:** Moderately sclerotized; vaginal sclerites moderate in size, weakly sclerotized. **Lower Vaginal Lip:** Continuous with upper vaginal lip; weakly sclerotized. Basal portion of spermathecal duct weakly to strongly sclerotized. Spermathecae 3, strongly sclerotized, spherical, 1 noticeably larger than others.

**MALES.** Generally similar to females except for sexual differences. Scutal scale patterns not as distinct as in females. **Head:** Proboscis long and slender, length about 1.35-1.55 of forefemur. Palpus long, about 1.00-1.20 of proboscis; 5 segmented, segments 2 and 3 ankylosed and long, making up about 0.50-0.80 of palpus; segment 4 short, making up about 0.10-0.20 of palpus; segment 5 short, making up about 0.07-0.20 of palpus; segment 3 slightly elevated and slightly swollen near apex with segments 4 and 5 slightly downturned, ventral surface of apex of segment 3 and all of segment 4 and often base of segment 5 densely covered with well developed setae; or, segment 3 uniformly slender and straight to apex, segments 4 and 5 not downturned and segments 3 and 5 with few short setae near apex; palpus entirely dark scaled. Antenna shorter than proboscis, about 0.65-0.90 of proboscis; pedicel much enlarged, without scales; flagellum strongly plumose, segments 1-12 with numerous long setae directed dorsad and ventrad and fewer shorter setae directed mesad; segment 1 with few scales, segments 12 and 13 elongate, the two combined subequal in length to total length of preceding 11 segments. **Thorax:** Scutal scale pattern often not as distinct as in female, with light scales usually more extensive. **Legs:** Relatively short, forefemur about 0.90-1.20 of distance from top of thorax to apex of midcoxa. Anterior claw of foreleg moderately to considerably enlarged, with blunt submedian tooth and with or without acute basal tooth; poster-



ior claw of foreleg moderately enlarged, with acute basal tooth; anterior claw of midleg greatly enlarged, with blunt submedian tooth and with or without acute basal tooth; posterior claw of midleg small or moderately enlarged, with acute subbasal or basal tooth; claws of hindleg small, with acute median or submedian tooth. **Abdomen:** Distal segments and genitalia not bent ventrad. Terga with basolateral white scale patches, dark scaled dorsally or with narrow basal white bands. Sterna usually mostly white scaled.

**MALE GENITALIA. Segment IX:** Tergum well developed, middorsal portion usually deeply emarginate on anterior margin with a weakly sclerotized, narrow to moderately broad caudal bridge connecting the small, prominent tergal lobes; each lobe with 1-10 moderately to strongly developed setae; sternum large, with 2-4 setae distally. **Sidepiece:** Well developed, cylindrical but slightly curved inward, length about 2.5-4.5 times median width; mesal surface membranous from base to apex; scales usually restricted to lateral surface; tergal surface with few to numerous short to moderately long setae, with several thickened and elongate setae at level of base of apical lobe (subapicotergal setae); lateral and sternal surfaces with few thickened and elongate setae; sternomesal margin with few to numerous moderately to well developed setae extending from level of basal lobe to clasper; apical tergomesal lobe poorly to well developed, with few small setae; basal tergomesal lobe attached to sidepiece, with 1 specialized basal differentiated seta that is thickened near base, bent beyond middle and usually hooked at apex, a cluster of about 10-30 undifferentiated setae distally or posteriorly on lobe and rarely 1 enlarged seta on ventral side of lobe which is stronger than undifferentiated setae but considerably weaker than differentiated seta; lobe often collapsed or folded ventrad in slide preparations. **Claspette:** Stem slender and elongate, curved dorsad, usually with single seta arising from conspicuous tubercle on ventral surface near base; filament usually subequal in length to stem, narrow at base, expanded near middle, with or without retrorse process on outer margin and tapering to acute, often recurved apex. **Clasper:** Simple, long, slightly expanded before or near middle, with conspicuous spicules, mostly on inner surface, curved inwardly distally; spiniform long and slender. **Phallosome:** Aedeagus small, simple, pyriform to ovate, sclerotized dorsally with slight apical emargination. **Proctiger:** Strongly developed; basolateral sclerotization strongly developed, vertical, produced into lateral tergal lobe ventrad of lobe of tergum IX; paraproct strongly sclerotized, broadly joined to basolateral sclerotization, with a single, large, heavily sclerotized apical tooth and a short, strongly sclerotized mesal process; cercal setae short, fine, 1-6.

**PUPAE. Cephalothorax:** Weakly to moderately brown pigmented, leg cases and dorsum usually slightly darker. Setae 1-3-C moderately developed, subequal, usually double (1-4b). Seta 6-C weakly developed, with 2-7 distal forks. Seta 7-C moderately developed, with 2-8 distal forks. Seta 8-C arising anterior to level of base of trumpet, subequal to and usually with more branches than 9-C, which arises considerably posterior to level of base of trumpet. Setae 10-12-C subequal in length, 10-C 4-8b, 11-C single (1-2b), 12-C usually 3-5b. **Trumpet:** Uniformly pigmented, light brown to dark brown, considerably darker than cephalothorax. Broadening gradually from base to apex; pinna small. Reticulate sculpturing strong, tracheoid sculpturing absent. **Abdomen:** Weakly to strongly pigmented, light yellowish brown to dark brown, lighter posteriorly; usually with area of stronger pigmenta-



tion on median anterior portion of most terga. Seta 1-II strong, multiple, 6-20 (4-27) branched, closer to midline than float hair (1-I); seta 1-IV moderately developed, usually 2-3(1-6) branched; seta 1-V similar in development to 1-IV though usually with fewer branches; seta 1-VII single to triple (1-5b). Seta 2-II variable in position, mesad or laterad of seta 3-II; seta 2-III-VII single, variable in position, usually immediately mesad of seta 1 of corresponding segment but often considerably displaced mesad, or slightly laterad of seta 1 on segments VI and VII. Seta 3-II single or double (1-5b), subequal to or weaker than 5-II; seta 3-III moderately developed, usually single (single or double); seta 3-V single to triple (1-6b); seta 3-VII usually 1-4 (1-5) branched. Seta 5-IV,V strongly developed, usually nearly as long as or exceeding length of following tergum, usually double (1-4b); seta 5-VI strongly developed, usually shorter than length of succeeding tergum, usually double (1-3b); seta 5-VII weakly developed, shorter than seta 3-VII, usually 2-4 (1-7) branched. Seta 6-I,II moderately long, fine; seta 6-III-VI moderately developed, fine, usually single or double, rarely 3 or 4 branched; seta 6-VII 2-10(2-21) branched. Seta 9-I-VI minute, single; seta 9-VII moderately developed, usually double (1-4b); seta 9-VIII strong, dendritic, usually with 6-8 main branches. **Terminal segments:** Male genital lobe about 0.9-1.3 of tergum VIII. Female cercus projecting beyond genital lobe, strongly sclerotized externally. **Paddle:** Very lightly pigmented; midrib darker, not extending to apex; external buttress indistinct. Marginal spicules very poorly developed. Apex usually slightly emarginate. Index about 1.0-1.3. Paddle hair 1-P well developed, long, single.

**LARVAE. Head:** Broader than long, maximum width about 1.4-1.6 of length, moderately pigmented, lighter in ocular area and darker posteriorly. Labial plate narrowed anteriorly. Seta 1-C stout. Setae 4,6-C displaced caudad, not near labrum. Seta 4-C weakly developed, usually 2-5 branched, caudad of level of 6-C. Seta 5-C usually single, occasionally 2-4 branched, more or less in line with 6-C and laterad of 1-C. Seta 6-C usually single, occasionally 2-3 branched. Seta 7-C usually 4-7 (2-11) branched. Seta 15-C short, multiple, 2-6 branched. Mental plate usually triangular with 13-16(10-18) teeth on each side of median tooth.

**Antenna:** Short, slender, uniformly weakly pigmented, with few spicules uniformly distributed over entire shaft. Seta 1-A moderately long, usually 2-5(1-9) branched, inserted near middle of shaft.

**Thorax:** Epidermis and fat body without conspicuous pigmentation. Integument with distinct spicules. Tubercles of setae 5-7-P separate. Seta 3-P single or multiple (1-5b). Seta 7-P usually triple, occasionally double (1-5b). Seta 1-M single or multiple (1-5b). Seta 11-M absent.

**Abdomen:** Seta 1-III moderately developed, usually 3-5(2-11) branched; seta 1-IV,V strongly developed, single or double, rarely 3-8 branched; seta 1-VII strongly developed, usually double, rarely single or triple. Seta 3-IV,V moderately developed, usually single or double (1-8b). Seta 6-I single to triple, usually double; seta 6-II usually double, rarely single; seta 6-III-VI usually single, rarely double. Seta 8-II weakly developed, usually double (1-3b). Seta 13-II weakly developed, multiple (5-25b); seta 13-III weakly developed and multiple or strongly developed, usually single (1-4b); seta 13-IV,V strongly developed, usually single (1-4b).

**Segment VIII:** Comb scales moderate to small in size; fringed; about 15-85 in number, in irregular double to triple row or triangular patch.

**Siphon:** Moderately pigmented, with darker basal band. Short to moderately long, index about 1.9 to 3.1. Acus distinct, attached, moderate in size. Pecten teeth 9-25, usually with basal denticles; in straight row, evenly spaced or with



distal teeth detached, and extending as far as distal 0.2 but usually extending only slightly beyond middle of siphon. Seta 1-S slightly distad of pecten, or within pecten in *thelcter* and *pectinatus*; moderately developed, 6-8(4-13) branched. 2-3 pairs of accessory dorsolateral setal tufts (2a-S) present in *crinifer*.

**Anal Segment:** Saddle completely encircling segment; moderately pigmented, with darker basal band; acus distinct, attached, moderate to small in size. Seta 1-X moderately developed, usually single (1-4b). Seta 2-X 7-10(5-19) branched. Seta 3-X single. Ventral brush (4-X) strongly developed, with 7 to 9 pairs of setal tufts; proximal setae usually arising from grid, occasionally arising from within or on margin of saddle. Anal gills varied in length, usually dorsal and ventral gills subequal.

**DISCUSSION.** The members of the Scapularis Group can be distinguished from all other New World *Aedes* by the following characters: in the females the antenna is shorter than the proboscis; the pleural scales are white, never silver; the paratergite is bare; the subspiracular scale patch is present though often reduced; the hypostigial scale patch is absent; the tarsal segments are without basal or apical light bands; and the wing scales are all dark except for a few white scales occasionally at the base of the costa. In the male genitalia, distinguishable from most Neotropical *Aedes*, the lobes of tergite IX are present and give rise to several stout setae; the apical tergomesal lobe of the sidepiece, when developed, is not thumblike and gives rise to no large setae; the basal tergomesal lobe is well developed, with a differentiated seta, and is completely attached to the sidepiece; the sternomesal margin of the sidepiece usually has more than 20 long setae between the basal tergomesal lobe and the base of the clasper; and the claspette stem has a single seta arising near the base. In the pupae the trumpet is broadened from base to apex; seta 1-II is closer to the midline than the float hair (1-I); seta 3-III is moderately developed, considerably shorter than the length of the succeeding tergite; seta 5-II is stronger than or at least subequal in development to seta 3-II; seta 5-IV,V is strong, subequal to or longer than the length of the succeeding tergum and usually double; seta 5-VII is weaker than seta 3-VII and usually less than a third the length of the succeeding tergum; the caudolateral margin of segments III or IV and V lack conspicuous denticles; the paddle is usually longer than broad, the marginal spicules are very poorly developed and the apex is usually slightly emarginate. In the larvae the thoracic and abdominal integument is spiculose; seta 13-VI is short, multiple and subequal to 13-II; the comb scales number 15 or more in an irregular double row or triangular patch; the anal saddle is complete; and the anal gills are not tracheate.

It is difficult, if not impossible, to determine relationships among the subgroups of the Scapularis Group and any attempts to infer relationships beyond the subgroup level, at this time, would be pure speculation. The arrangement of subgroups has been with what seem to be the more generalized forms, and, coincidentally the more common and widespread species, in the middle and the more extremely differentiated forms at either end. At a later time when more material, especially individual and progeny rearings of Scapularis Group species, a more thorough knowledge of the biogeography of other Neotropical aedine phylads and additional information from paleogeology and paleobiology of the Caribbean, Central American and northern South American areas is assembled, further conclusions on the phylogeny of the Scapularis Group may be drawn.



KEYS TO SUBGROUPS AND SPECIES

FEMALES

17. *comitatus* unknown

1. Scutum with large hexagonal patch or broad stripe of white to yellowish tan scales on anterior two-thirds, patch or stripe extending well laterad of dorsocentral line; posterior third of scutum often with narrow stripe of light scales on acrostichal and dorsocentral lines which are continuous with anterior scale patch . . . . . 2  
 Scutum with scales unicolorous, *or* with narrow to broad longitudinal lines of contrasting scales extending entire length of scutum, *or* with light and dark scales in pattern suggesting light longitudinal lines on dark background . . . . . 9
- 2(1) Hindtibia with conspicuous white stripe on anterior surface, occasionally nearly encircling tibia, and continued on basal tarsal segments; abdomen usually with indistinct pale median longitudinal stripe on posterior segments; proboscis pale ventrally (fig. 35) (Scapularis Subgroup) . . 3  
 Hindtibia entirely dark; abdomen entirely dark dorsally or with narrow basal segmental white bands; proboscis entirely dark . . . . . 4
- 3(2). Anterior scutal scale patch mostly tan, often yellow to white posteriorly (fig. 33) . . . . . 15. *phaeonotus*  
 Anterior scutal scale patch white, often yellow to tan on lateral margin (fig. 36) . . . . . 16. *scapularis*
- 4(2). Anterior scutal scale patch golden to tan (fig. 21) (Tortilis Subgroup) . . . . . 8. *tortilis*, 9. *auratus*  
 Anterior scutal scale patch entirely white or white divided by narrow acrostichal line of tan scales (Infirmitatus Subgroup) . . . . . 5
- 5(4). Anterior scutal white scale patch divided by narrow acrostichal line of tan scales (fig. 32) . . . . . 13. *raymondi*  
 Anterior scutal scale patch entirely white . . . . . 6
- 6(5). Knee spots of white scales present posteriorly on apices of femora, most conspicuous on mid and hind femora . . . . . 7  
 Knee spots of white scales absent . . . . . 8
- 7(6). Palpus apparently 3 segmented; distribution Central America and northern South America . . . . . 11. *euplocamus*  
 Palpus 4 segmented, segment 4 relatively large; distribution northern Argentina and southern Bolivia . . . . . 12. *patersoni*
- 8(6) Abdominal terga with median basal white patches or bands on most segments . . . . . 10. *condolescens*  
 Abdominal terga entirely dark dorsally . . . . . 14. *infirmitatus*



- 9(1). Scutum uniformly dark brown scaled, *or*, if slightly lighter scales present these restricted to posterior dorsocentral line . . . . . 10  
 Scutum with narrow to broad longitudinal lines of contrasting scales, *or* with scales unicolorous and light, *or* scales mixed light and dark in more or less random pattern . . . . . 12
- 10(9). Knee spots of white scales present on all femora; erect scales of head numerous, elongate, extending forward on vertex, mostly dark (Pectinatus Subgroup) . . . . . *21. pectinatus*  
 Knee spots of white scales absent; erect scales of head few, short, restricted to occiput, mixed light and dark . . . . . 11
- 11(10). Decumbent scales of vertex and occiput entirely white; pleural integument light brown . . . . . *24. Colombian form*  
 Occipital dark scale patch prominent; pleural integument dark brown (fig. 5) (Incomptus Subgroup) . . . . . *1. incomptus*
- 12(9). Scutal scales entirely yellowish white except for usual broad acrostichal line of light brown to golden scales; basal white scale patches of abdominal terga broader on midline, often forming median longitudinal white stripe (figs. 46,47) (Thelcter Subgroup) . . . . . *22. thelcter*  
 Scutal scales not as above . . . . . 13
- 13(12). Scutum with single dark narrow acrostichal line of white scales, remainder of scutum dark brown scaled . . . . . 14  
 Scutum not as above . . . . . 15
- 14(13). Posterior dorsocentral setae well developed; abdominal sterna with dark scales in longitudinal median line (fig. 8) (Bogotanus Subgroup) . . . . . *2. bogotanus, 3. deficiens*  
 Dorsocentral setae not developed except on anterior promontory; abdominal sterna entirely dark scaled or with dark scales only in distal segmental bands . . . . . *23. Surinam form*
- 15(13). Scutum with pale tan scales except for dark brown scales in narrow acrostichal line and usually on lateral scutal margin; pleural line tan to light brown (figs. 41,42) (Obturbator Subgroup)..*20. obturbator*  
 Scutal scales not as above; pleural integument dark brown . . . . . 16
- 16(15). Scutum with 2 narrow to broad lines of white to yellow scales in dorsocentral area, these lines continuous and distinct or somewhat irregular (Trivittatus Subgroup) . . . . . 17  
 Scutum with broad median line of white or yellow scales usually separated into 3 distinct lines by brown scales laterad of midline, *or* scales mixed light and dark in more or less random pattern suggesting 3 light lines on dark background (Crinifer Subgroup) . . . . . 20
- 17(16). Knee spots of white scales present at apices of femora, most conspicuous on mid and hind femora . . . . . 18  
 Knee spots of white scales absent . . . . . 19



- 18(17). Dorsocentral line of white or yellow scales complete, unbroken from anterior promontory to scutellum and usually expanded laterad in supraalar area (figs. 17,18) . . . . . 7. *trivittatus*  
Dorsocentral line of white scales usually incomplete, broken at level of prescutal suture and usually doubled posteriorly, as posterior dorsocentral line and supraalar line (fig. 13). . . . . 4. *atactavittatus*
- 19(17). Dorsocentral line of yellow to white scales uniformly narrow along entire length, not expanded or divided in supraalar area (fig. 15) . . . . . 6. *angustivittatus*  
Dorsocentral line of white scales expanded laterad in antealar and supraalar areas, with elongate patch of dark scales laterad of posterior dorsocentral line (fig. 32). . . . . 5. *meprai*
- 20(16). Scutum with broad median line of white or yellow scales usually separated into 3 distinct lines by brown scales laterad of midline (figs. 38, 39) . . . . . 18. *crinifer*  
Scutum with white to yellow scales on background of dark brown scales in somewhat random pattern but suggesting 3 longitudinal lines (fig. 41) . . . . . 19. *synchytus*

# MALE GENITALIA

(3. *deficiens*, 5. *meprai*, 13. *raymondi* unknown)

1. Sidepiece short and broad, length about 2.5 times median width; basal tergomesal lobe with about 25-35 setae, differentiated seta only slightly larger than largest of undifferentiated setae (fig. 47) . . . 22. *thelcter*  
Sidepiece length at least 3.5 times median width; basal tergomesal lobe usually with fewer than 25 setae, differentiated seta much larger than undifferentiated setae . . . . . 2
- 2(1). Claspette filament considerably longer than stem, straight and uniformly narrow on basal two-thirds, then slightly broadened with small retrorse process; spiniform long, length about 20 times greatest width (fig. 41) . . . . . 20. *obturator*  
Claspette filament subequal in length to stem, curved dorsad at base, broadened near or before middle; spiniform shorter, length less than 15 times greatest width . . . . . 3
- 3(2). Sternomesal margin of sidepiece with fewer than 30 relatively short setae; differentiated seta of basal tergomesal lobe straight distad of middle; apical tergomesal lobe of sidepiece not developed (fig. 44) . . . . . 21. *pectinatus*  
Sternomesal margin of sidepiece with more than 30 setae; differentiated seta of basal tergomesal lobe curved distad of middle; apical tergomesal lobe at least moderately developed . . . . . 4



- 4(3). Claspette stem narrow, length about 10 times median width, curved dorsad on basal two-thirds and slightly recurved ventrad on distal third; filament expanded just distad of retrorse process to about 3-4 times basal width; apical tergomesal lobe very well developed; basal tergomesal lobe with 20-30 setae (figs. 39,41) . . . *18. crinifer, 19. synchytus*  
 Claspette stem length about 6 times median width, broadly curved dorsad; filament expanded just distad of retrorse process to about 1.5-2 times basal width; apical tergomesal lobe moderately to well developed; basal tergomesal lobe usually with fewer than 25 setae . . . . . 5
- 5(4). Claspette filament without retrorse process, or with retrorse process minute and without spicules basad of process . . . . . 6  
 Claspette filament with large retrorse process and usually several elongate spicules basad of process . . . . . 7
- 6(5). Basal tergomesal lobe of sidepiece with conspicuous enlarged ventral seta, weaker than differentiated seta but stronger than undifferentiated setae (fig. 32) . . . . . *17. comitatus*  
 Basal tergomesal lobe of sidepiece without enlarged ventral seta (figs. 33, 36) . . . . . *15. phaeonotus, 16. scapularis*
- 7(5). Sternomesal margin of sidepiece with about 75 (65-85) well developed setae between basal tergomesal lobe and clasper (fig. 30) . . *14. infirmatus*  
 Sternomesal margin of sidepiece with fewer than 60 setae between tergomesal lobe and clasper . . . . . 8
- 8(7.) Sternomesal margin of sidepiece with about 30 setae between basal tergomesal lobe and clasper (fig. 13) . . . . . *4. atactavittatus*  
 Sternomesal margin of sidepiece with 40 to 50 or 60 setae between basal tergomesal lobe and clasper . . . . . 9
- 9(8). Tergal surface of sidepiece with distinct bare space between subapicotergal setae and much shorter, more proximal tergal setae; about 25-30 setae on basal tergomesal lobe (fig. 24) . . . . . *9. auratus*  
 Tergal surface of sidepiece without bare space between subapicotergal setae and more proximal tergal setae; setae of basal tergomesal lobe fewer than 25, usually fewer than 20 . . . . . 10
- 10(9). Claspette stem expanded into calyciform apex; spiniform short, length 7 to 10 times greatest width; subapicotergal setae 5 or 6 in oblique row (fig. 15) . . . . . *6. angustivittatus*  
 Claspette stem not expanded distally; spiniform length at least 10 times greatest width; subapicotergal setae usually fewer than 5 (figs. 6,9,18, 21,24,25,27) . . . . .  
*1. incomptus, 2. bogotanus, 7. trivittatus, 8. tortilis, 10. condolescens, 11. euplocamus, 12. patersoni*



LARVAE

(5. *meprai*, 10. *condolenscens*, 13. *raymondi*, 15. *comitatus*, 19. *synchytus* unknown)

1. Siphon with 2 or 3 pairs of accessory dorsolateral setae (2a-S) subequal in development to seta 1-S (fig. 40) . . . . . 18. *crinifer*  
Siphon without accessory dorsolateral setae (2a-S) . . . . . 2
- 2(1). Pecten teeth extending well beyond insertion of seta 1-S . . . . . 3  
Pecten teeth ending before or near insertion of seta 1-S . . . . . 4
- 3(2). Comb scales about 60-70, in triangular patch; seta 1-VII single, subequal to siphon length (fig. 45) . . . . . 21. *pectinatus*  
Comb scales about 16-20, in irregular double row; seta 1-VII 3 or 4 (2-5) branched, short, less than 0.5 of siphon length (fig. 48) . . . . . 22. *thelcter*
- 4(2). Seta 6-I,II single . . . . . 5  
Seta 6-I,II double or triple . . . . . 7
- 5(4). Siphon with acute ventroapical prolongation subequal in length to ventro-lateral valve; ventral brush with 7 pairs of setal tufts; anal saddle with short, acute spicules on dorsocaudal margin (fig. 43) . . 20. *obturbator*  
Siphon without ventroapical prolongation; ventral brush with 8 or 9 pairs of setal tufts; anal saddle without spicules on dorsocaudal margin . . 6
- 6(5). Ventral brush with 9 pairs of setal tufts; seta 13-III well developed, double, subequal to 13-IV,V; setae double or triple (fig. 12) . . . . . 3. *deficiens*  
Ventral brush with 8 pairs of setal tufts; seta 13-III small, multiple, subequal to 13-II, setae 1,13-IV,V well developed, subequal, single (fig. 23) . . . . . 9. *auratus*
- 7(4). Seta 5-C 2-4 branched, seta 6-C single; ventral brush with 8 or 9 pairs of setal tufts (fig. 10) . . . . . 2. *bogotanus*  
Seta 5,6-C single; ventral brush with 8 pairs of setal tufts . . . . . 8
- 8(7). Seta 13-III small, multiple, subequal to 13-I,II (fig. 22) . . . . 8. *tortilis*  
Seta 13-III well developed, single, subequal to 13-IV,V . . . . . 9
- 9(8). Seta 6-I usually triple, seta 6-II-VI usually double (fig. 14) . . . . . 6. *atactavittatus*  
Seta 6-I,II usually double, seta 6-III-VI usually single . . . . . 10
- 10(9). Comb scales with well-differentiated median spinule, at least 2.5 to 3 times length of submedian spinules (fig. 31) . . . . . 14. *infirmatus*  
Spinules of comb scales subequal, or median spinule less than 2 times length of submedian spinules . . . . . 11
- 11(10). Spicules of integument very sparse and short, length less than twice basal diameter (fig. 7) . . . . . 1. *incomptus*



- Spicules of integument numerous and conspicuous, long, length about 4-10 times basal diameter . . . . . 12
- 12(11). Seta 3-P usually at least double (2-5b), very rarely single . . . . . 13  
 Seta 3-P single, never double . . . . . 14
- 13(12). Seta 1-III 6-8 branched (fig. 34) . . . . . 15. *phaeonotus*  
 Seta 1-III usually triple (1-5b) (fig. 37) . . . . . 16. *scapularis*
- 14(12). Seta 1-IV,V usually double; very rarely single . . . . . 15  
 Seta 1-IV,V usually single, rarely double . . . . . 16
- 15(14). Comb scales without enlarged median spinule, all spinules subequal; spicules of integument long, length about 6-10 times basal diameter (fig. 16) . . . . . 6. *angustivittatus*  
 Comb scales with median spinule enlarged, slightly longer and more prominent than lateral spinules; spicules of integument moderately long, length about 4-5 times basal diameter (fig. 19) . . . . . 7. *trivittatus*
- 16(14). Seta 6-III single; spicules of integument moderately long, length about 4-6 times basal diameter (fig. 26) . . . . . 11. *euplocamus*  
 Seta 6-III usually double; spicules of integument long, length about 8-12 times basal diameter (fig. 28) . . . . . 12. *patersoni*

### INCOMPTUS SUBGROUP

#### 1. *Aedes (O.) incomptus* Arnell, sp. n.

Figs. 1,5,6,7

**TYPES.** *Holotype* female with associated pupal skin (PA 379-110), 6.5 km W of summit of Cerro Mali, Serrania del Darien (approx. 29 km NE Pucro), Darien, Panama, elev. 1500 m, larva taken from water hole of collared peccaries in marginal cloud forest, 8 June 1963, A. Quinonez [USNM]. *Allotype* male with associated pupal skin and genitalia slide (PA 379-146), same data as holotype [USNM]. *Paratypes:* 28 pM (PA 379-101,102,104,109,113-115,120,121,125-127,130,132,133,141,142,144,145,149,151-153,157), 23 pF (PA 379-103,111,116,117,119,122,124,128,129,134,135,137,138-140,143,147,148,150,155,156,158,162), 3 p, 36 l, 4 L, same data as holotype [UCLA, BM, GML, FH].

**FEMALE** (figs. 5,6). Wing: 3.15 mm. Proboscis: 2.05 mm. Forefemur: 1.60 mm. Abdomen: 2.70 mm. **Head:** Occipital dorsolateral dark scale patch prominent. Erect scales mostly gray or dark. Palpus 4 segmented. **Thorax:** Scutum covered entirely with dark brown scales, or with few light brown scales in narrow posterior dorsocentral line and surrounding prescutellar bare space. Acrostichal setae usually absent, anterior dorsocentral and posterior fossal setae present. Scutellum with dark brown scales on lobes. **Legs:** Forecoxa with extensive area of dark scales anteriorly. Knee spots of white scales absent posteriorly on apices of femora. Tibiae and basal tarsal segments of foreleg and midleg with light streak posteriorly, hindtibia and hindtarsus entirely dark scaled. Claws of hindleg with submedian tooth. **Wing:** Scales entirely dark. **Abdomen:** Terga entirely dark scaled dorsally.



**MALE** (figs. 5,6). Wing: 3.15 mm. Proboscis: 2.05 mm. Forefemur: 1.55 mm. Abdomen: 2.75 mm. **Thorax**: Scutum mostly dark scaled except for lighter scales along posterior dorsocentral line and in supraalar area, areas of lighter scales often indistinct. **Legs**: Anterior claw of foreleg and midleg considerably enlarged, with blunt submedian tooth and acute basal tooth.

**MALE GENITALIA** (fig. 6). **Segment IX**: Anterior middorsal emargination of tergum broadly conical and relatively shallow, caudal bridge connecting tergal lobes broad; tergal lobes with 4-7 setae. **Sidepiece**: Length about 3.5-4.5 times median width; sternomesal margin with 50-60 moderate to long setae; apical tergomesal lobe well developed; basal tergomesal lobe well developed, triangular with anterior side shorter, lobe often collapsed or folded ventrad in slide preparations, with about 20 setae. **Claspette**: Stem long, uniformly narrow, broadly curved dorsad, basal seta relatively small; filament slightly shorter than stem, narrow at base and broadened considerably near middle with large retrorse process and 5-10 elongate spicules basad of retrorse process extending to about basal 0.1 of filament, and tapered gradually to recurved tip. **Clasper**: Sharply curved inward distally; spiniform length about 12-14 times its greatest width. **Phallosome**: Aedeagus ovate to slightly pyriform.

**PUPA** (fig. 6). Abdomen: 2.55 mm. Trumpet: 0.40 mm. Paddle: 0.75 mm. **Cephalothorax**: Weakly pigmented, very slightly darker dorsally. Seta 8-C with at least 9(9-14) branches; seta 9-C 4, rarely 3 or 5 branched. **Abdomen**: Weakly pigmented, very slightly darker anteriorly. Seta 1-IV 5(4-6) branched. Seta 5-IV-V subequal in length to length of succeeding tergum, 5-VI shorter than length of succeeding tergum, all double (5-IV rarely triple). Seta 6-III,IV usually 4(2-5) branched; seta 6-V triple, occasionally 4 branched. **Paddle**: Seta 1-P usually forked near base.

**LARVA** (fig. 7). Head: 0.80 mm. Siphon: 0.75 mm. Anal Saddle: 0.35 mm. **Thorax**: Spicules of integument sparse, inconspicuous, length about 2 times basal diameter. Seta 3-P single. **Abdomen**: Seta 6-I,II double; 6-III-VI single. Seta 13-III strongly developed, single. **Segment VIII**: Comb scales moderate in size, evenly fringed, about 22-28 in number, in irregular double to triple row. **Siphon**: Index 2.3-2.5. Pecten with teeth evenly spaced, extending to middle of siphon. Seta 1-S inserted slightly distad of distal pecten tooth. **Anal Segment**: Ventral brush (4-X) with 8 pairs of setal tufts.

**SYSTEMATICS**. *Aedes incomptus* can be separated from the other species of the Scapularis Group by the following characters: in the female (1) the scutum is nearly completely dark brown scaled with occasional lighter brown scales on the posterior dorsocentral line, (2) there are no knee spots of white scales on the apices of the femora, and (3) the occipital dark scale patch is prominent; in the male genitalia (1) the sternomesal margin of the sidepiece has 50 to 60 long setae between the basal tergomesal lobe and the clasper, (2) there is no bare space between the subapicotergal setae and the more proximal shorter setae of the sidepiece, (3) the claspette stem is broadly curved dorsad and not expanded distally, and (4) the claspette filament is shorter than the stem, has a large retrorse process and several elongate spicules basad of the process with the most proximal spicules near the basal 0.1 of the filament; in the larva (1) the spicules of the thoracic and abdominal integument are sparse and short, length about 2 times basal diameter, (2) seta 13-III is well developed, single, subequal to 13-IV,V, (3) the siphon index is less than 2.5, and (4) the comb scales are evenly fringed.

*Aedes incomptus* shows no close affinities to any other Scapularis Group species.



It appears to be, in all stages, one of the more generalized members of the group. The female shows no unusual characters other than the completely dark scaled scutum, the male genitalia are indistinguishable from several other species of the group, and the larva is distinguished mainly by the minute development of the thoracic and abdominal integumental spicules. Known only from a single locality in Panama, *incomptus* may be the remnants of a developmental line close to the ancestral stock that gave rise to the Scapularis Group.

**BIONOMICS.** Nothing is known of the bionomics of *incomptus* other than that the type series was collected in a marginal cloud forest from a small ground pool used as a water hole by collared peccaries. The pool contained larvae of *Psorophora* (J.) sp and *Culex* (Mel.) sp near *jubifer*, was in deep shade and contained no vegetation.

**DISTRIBUTION** (fig. 1). *Aedes incomptus* is known only from a single locality in the Serrania del Darien, Darien Province, Panama. Material examined: 149 specimens; 29 males, 24 females, 56 pupae, 40 larvae; 53 individual rearings (pupal).

**PANAMA. Darien:** Cerro Mali, 6.5 km W of summit, type series, see above.

### BOGOTANUS SUBGROUP

**DISCUSSION.** The Bogotanus Subgroup is defined by the female scutal ornamentation of dark brown scales divided by a narrow acrostichal line of white scales. The females of the 2 species in the subgroup, *bogotanus* and *deficiens*, are apparently indistinguishable, *deficiens* is unknown in the male, and the larvae of the 2 species are well marked and easily distinguished.

The subgroup is known from only a few collections in the immediate vicinity of Bogota, Colombia.

#### 2. *Aedes* (O.) *bogotanus* Arnell, sp. n.

Figs. 1,8,9,10

**TYPES.** *Holotype* female with associated larval and pupal skins (COB 96-11), Ogamora, nr. Soacha, Cundinamarca, Colombia, elev. 2400 m, larva from volcanic rockhole, 28 Nov 1965, Ochoa [USNM]. *Allotype* male with associated larval and pupal skins and genitalia slide (COB 93-11), "Las Acacias," nr. Usaquen, Cundinamarca, Colombia, elev. 2640 m, larva from small ground pool in garden, 8 Nov 1965, E. Osorno [USNM]. *Paratypes:* 3 lpM (COB 93-10,12,13), 1 lpF (COB 93-14), same data as allotype; 2 lpF (COB 96-10,12), 3 L (COB 96), same data as holotype [UCLA, BM].

**FEMALE** (figs. 8,9). Wing: 4.55 mm. Proboscis: 2.85 mm. Forefemur: 2.05 mm. Abdomen: 3.30 mm. Proboscis and legs relatively long. **Head:** Occipital dorsolateral dark scale patch conspicuous. Proboscis relatively long, about 1.35-1.45 of forefemur. Antenna about 0.75 of proboscis. Palpus apparently 3 segmented. **Thorax:** Scutum with narrow acrostichal line of white scales from anterior promontory to scutellum, surrounding prescutellar bare space; remainder of scutum with dark brown scales except for few white scales above paratergite and on anterior humeral margin. **Legs:** Legs relatively long, forefemur about 1.20-1.25 of distance from top of thorax to apex of midcoxa. Knee spots of white scales absent on posterior of apices of femora. Tibiae and basal tarsal segments with white streak posteriorly. Claws of hindleg with submedian tooth. **Wing:** Scales entirely dark,



or, occasionally with small patch of white scales at extreme base of costa. **Abdomen:** Terga apparently entirely dark scaled dorsally. Sternum with dark scales in distinct, longitudinal median line.

**MALE** (figs. 8,9). Wing: 4.80 mm. Proboscis: 3.50 mm. Forefemur: 2.20 mm. Abdomen: 3.95 mm. **Head:** Proboscis long, subequal in length to palpus. **Thorax:** Scutum with broad acrostichal stripe of white scales, somewhat widened posteriorly; remainder of scutum with dark scales. **Legs:** Anterior claw of foreleg and midleg considerably enlarged, with blunt submedian tooth and acute basal tooth.

**MALE GENITALIA** (fig. 9). **Segment IX:** Anterior middorsal emargination of tergum shallow and relatively narrow, caudal bridge connecting tergal lobes broad; tergal lobes about as broad as high, with 5-8 setae. **Sidepiece:** Length about 4.0-4.5 times median width, tergal surface with setae sparse and uniformly relatively short and cluster of 5-8 subapicotergal setae; sternomesal margin with about 50-60 long setae, most dense at level of base of apical tergomesal lobe; apical tergomesal lobe very well developed; basal tergomesal lobe well developed, triangular with anterior side shorter and setae arising from posterior side, differentiated seta large, about 20 undifferentiated setae of 2 distinct sizes, long near periphery of cluster and much shorter in center of cluster, 4 or 5 long setae usually projecting distad from posterior side of lobe. **Claspette:** Stem long, uniformly narrow and broadly curved dorsad; filament narrow at base, expanded near basal third with large retrorse process and several elongate spicules basad of retrorse process, and tapered to recurved tip. **Clasper:** Narrow, only slightly broadened near middle; spiniform length about 12-15 times its greatest width. **Phallosome:** Aedeagus ovate to slightly pyriform.

**PUPA** (fig. 9). Abdomen: 2.85 mm. Trumpet: 0.45 mm. Paddle: 0.95 mm. **Cephalothorax:** Weakly pigmented, slightly darker dorsally. **Abdomen:** Weakly pigmented, only slightly darker anteriorly, but strongly pigmented at base of segment III. Seta 1-VII single. Seta 5-IV,V longer than length of succeeding tergum, both always single; seta 5-VI subequal in length to length of succeeding tergum, single, very rarely double. **Paddle:** Apex broadly rounded or slightly pointed, very rarely emarginate.

**LARVA** (fig. 10). Head: 1.10 mm. Siphon: 1.20 mm. Anal Saddle: 0.45 mm. **Head:** Seta 5-C 4(3-4) branched. **Thorax:** Spicules of integument dense, conspicuous, length about 6-8 times basal diameter. Seta 3-P double (2-3b). Seta 7-P usually triple (3-5b). **Abdomen:** Seta 1-III 7-9(5-11) branched; seta 1-IV double (2-3 branched); seta 1-VII triple. Seta 6-I,II double; seta 6-III-VI single. Seta 13-III strongly developed, double; seta 13-IV double; seta 13-V triple (2-3b). **Segment VIII:** Comb scales moderate in size, with slightly differentiated median spinule, 19-24 in number, in irregular double to triple row. **Siphon:** Index about 2.6-3.1. Pecten with teeth evenly spaced, extending to middle of siphon. Seta 1-S inserted distad of pecten, 9(7-12) branched. **Anal Segment:** Ventral brush (4-X) with 8 or 9 pairs of setal tufts.

**SYSTEMATICS.** *Aedes bogotanus* can be separated from the other species of the Scapularis Group by the following characters: in the female, indistinguishable from *deficiens*, the scutum has a narrow acrostichal line of white scales with the remainder of the scutum covered with dark brown scales, and posterior dorsocentral setae are well developed; in the male genitalia, generally indistinguishable from *trivittatus*, *tortilis*, *condolescens*, *euplocamus* and *patersoni*, (1) the sidepiece length is 4 to 4.5 times median width, (2) the claspette filament is subequal in length to the stem and has a large retrorse process with several elongate spicules basad of the



process, the spicules seldom extending basad of the basal 0.2 of the filament, (3) the sternomesal margin of the sidepiece has 50 to 60 long setae between the basal tergomesal lobe and the clasper, (4) the claspette stem is broadly curved dorsad and not expanded distally, (5) the apical tergomesal lobe of the sidepiece is moderately to well developed, and (6) the spiniform length is about 12 to 15 times its greatest width; in the larva (1) seta 5-C is 2-4 branched, (2) seta 6-C is single, (3) seta 6-I,II is double, and (4) the ventral brush has 8 or 9 pairs of setal tufts.

The apical tergomesal lobe of the sidepiece of the male genitalia is generally larger in *bogotanus* than in the species from which I have considered it indistinguishable, but this character is inconstant in slide preparations and too subjective to be of value. This species appears to be closely related to *deficiens*, this relationship being discussed further under *deficiens* below.

The name *bogotanus* is a manuscript name that W. H. W. Komp placed on a number of specimens of this species that he collected near Bogota in May and June 1942.

**BIONOMICS.** *Aedes bogotanus* is known only from the vicinity of Bogota, Colombia. Larvae have been collected on 2 occasions, once from a small, temporary ground pool in a garden, the pool containing abundant vegetation and larvae of *Aedes* (*O.*) sp near *euiris*, and once from a volcanic rockhole in a pasture, with water temporary and without vegetation, and containing larvae of *A.* (*O.*) sp near *euiris* and *Uranotaenia* sp. Several collections made by W. H. W. Komp and his associates in 1942 were adults, mostly males, taken sweeping.

**DISTRIBUTION.** *Aedes bogotanus* is known only from the vicinity of Bogota, Cundinamarca, Colombia. Material examined: 89 specimens; 42 males, 28 females, 8 pupae, 11 larvae; 8 individual rearings (larval).

**COLOMBIA.** Cundinamarca: Bogota, 28 Feb 1922, F. Miller, 1 M [USNM]. Bogota, 1 Mar 1937 (COR 529), 6 F [UCLA]; same data (COR 530), 4 F [UCLA]. Bogota, 24 May 1942, W. Komp (KO 200-12, KO 200-15, COK 67), 19 M, 7 F [UCLA]; same data, 2 M, 1 F [USNM]. Bogota, June 1942, W. Komp (KO 200-7), 11 M, 1 F [UCLA]; same data, 1 F [USNM]. Bogota, May 1944, W. Komp (COK 68), 1 F [UCLA]. Fontibon, 19 May 1942, W. Komp (KO 200-14, COK 15), 5 M, 2 F [UCLA]. Soacha, type series, see above. Usaquen, type series, see above.

### 3. *Aedes* (*O.*) *deficiens* Arnell, sp. n.

Figs. 1,11,12

**TYPES.** *Holotype* female with associated larval and pupal skins (COB 92-10), Hacienda "Conjera," 3 km from Suba, Cundinamarca, Colombia, elev. 2410 m, larva taken from ground pool in pasture, 7 Nov 1965, Morales, Ochoa and Pardo [USNM]. *Paratypes*: 2 lpF (COB 92-11,12), same data as holotype [UCLA].

**FEMALE** (fig. 11). Wing: 3.55 mm. Proboscis: 2.20 mm. Forefemur: 1.70 mm. Abdomen: 2.75 mm. Apparently indistinguishable from *bogotanus*.

**MALE.** Unknown.

**PUPA** (fig. 11). Abdomen: 3.05 mm. Trumpet: 0.50 mm. Paddle: 0.80 mm. Cephalothorax: Very weakly pigmented, only slightly darker dorsally. Abdomen: Weakly pigmented, very slightly darker anteriorly, strongly pigmented at base of segment III. Seta 1-VII double (rarely single or triple). Seta 5-IV,V subequal in length to length of succeeding tergum, double on segment IV, single on segment V; seta 5-III shorter than length of succeeding tergum, single (single or double). Seta 6-IV triple. Seta 14-VIII relatively long and conspicuous, subequal to seta 11-VII, single to triple. Paddle: Apex slightly emarginate.



LARVA (fig. 12). Head: 1.00 mm. Siphon: 0.85 mm. Anal Saddle: 0.35 mm. Head: Seta 5-C double. Seta 6-C single. Thorax: Spicules of integument moderately dense, length about 6-8 times basal diameter. Seta 3-P double (2-4b). Seta 7-P triple. Abdomen: Seta 6-I-VI single. Seta 13-III strongly developed, double (1-2b); seta 13-IV double; seta 13-V triple. Segment VIII: Comb scales small in size, evenly fringed, about 42-56, in triangular patch. Siphon: Index about 2.25-2.40. Pecten with teeth evenly spaced, extending to middle of siphon. Seta 1-S inserted distad of pecten, 9(7-9) branched. Anal Segment: Ventral brush (4-X) with 9 pairs of setal tufts.

SYSTEMATICS. *Aedes deficiens* can be separated from the other species of the Scapularis Group by the following characters: in the female, indistinguishable from *bogotanus*, the scutum has a narrow acrostichal line of white scales and the remainder of the scutum covered with dark brown scales; in the pupa seta 14-VIII is relatively well developed, subequal to 11-VII and single to triple; in the larva (1) seta 6,I,II is single, (2) the ventral brush has 9 pairs of setal tufts, and (3) seta 13-III is well developed and subequal to 13-IV,V.

This species shows no characters in the female to distinguish it from *bogotanus*, although the 3 females known of *deficiens* are depauperate and in extremely poor condition. Distinguishing characters may be found when better specimens are examined. The species can be distinguished from *bogotanus* in the pupa and is very well marked in the larva. It is probably closely related to *bogotanus*; however exact placement must await discovery of the male and examination of additional females. Although known only from a single collection, *deficiens*, as well as *bogotanus*, may have a more extensive distribution than is now known, since the aedine fauna of the higher elevations of the Andes is relatively poorly known.

BIONOMICS. *Aedes deficiens* has been collected only once, from a small, semi-permanent ground pool in a pasture, the pool containing abundant herbaceous vegetation. Larvae of *Aedes (O.) milleri* were also present.

DISTRIBUTION. *Aedes deficiens* is known only from a single locality near Bogota, Colombia. Material examined: 9 specimens; 3 females, 3 pupae, 3 larvae; 3 individual rearings (larval).

COLOMBIA. Cundinamarca: Suba, type series, see above.

### TRIVITTATUS SUBGROUP

FEMALES. Head: Occipital dorsolateral dark scale patch conspicuous to nearly absent. Palpus 3 segmented. Thorax: Scutum with dorsocentral line of white or yellow scales extending entire length of scutum, this line continuous and distinct or somewhat diffuse; white or yellow scales mesally on anterior promontory, surrounding prescutellar bare space, and often above paratergite; remainder of scutum with golden brown to dark brown scales. Acrostichal, anterior dorsocentral, and posterior fossal setae absent. Legs: Knee spots of white scales present or absent posteriorly on apices of femora. Tibiae and basal tarsal segments with white streak posteriorly; hindtibia and hindtarsus dark scaled anteriorly. Claws of hindleg with submedian tooth. Wing: Scales entirely dark. Abdomen: Terga II-VII with large basolateral white scale patches; entirely dark scaled dorsally, with basal white bands, or basomedian white patches.

MALES. Thorax: Scutal scale pattern generally similar to female although longitudinal lines of light scales usually more extensive laterally; occasionally scutum al-



most entirely light scaled. **Legs:** Anterior claw of fore leg considerably enlarged, with blunt submedian and acute basal tooth, posterior claw of foreleg considerably enlarged, with acute subbasal tooth; anterior claw of midleg with blunt submedian and acute basal tooth, posterior claw of midleg small or moderately enlarged, with acute subbasal tooth. **Abdomen:** Terga with or without basal bands of white scales.

**DISCUSSION.** The *Trivittatus* Subgroup is defined by the female scutal ornamentation of 2 narrow to broad dorsocentral lines of light scales extending the entire length of the scutum. The pleural integument is dark brown in color, in contrast to the light brown integument of *obturbator*, which has a somewhat similar scutal scale pattern.

The subgroup consists of 4 species, *atactavittatus*, *meprai*, *angustivittatus*, and *trivittatus*, with an extensive distribution from southern Canada through Central America and western South America to northern Argentina (see fig. 2). The 2 dominant species of the subgroup are *trivittatus* in Canada, the United States except for the Pacific Coast states and Mexico as far south as Oaxaca, and *angustivittatus*, extending from central Mexico to Venezuela, Colombia and Ecuador. There is a zone of hybridization between these 2 species in southern Mexico, discussed below under *angustivittatus*. *Aedes atactavittatus* has a restricted distribution in Campeche, Mexico, and *meprai* is known from southern Ecuador, southern Bolivia and northern Argentina and may possibly have a continuous distribution from Ecuador to Argentina. The distribution pattern for the subgroup is similar to that of the *Infirmatus* Subgroup, except that the latter is represented in the Antilles. This similarity may indicate a parallel evolutionary history, especially in Central and South America.

#### 4. *Aedes (O.) atactavittatus* Arnell, sp. n.

Figs. 2,13,14

**TYPES.** *Holotype* female with associated larval and pupal skins (MEX 610-16), E outskirts Lerma, Campeche, Mexico, elev. 6 m, larva taken from rockhole in back yard of dwelling, 5 Aug 1970, D. Schroeder [USNM]. *Allotype* male with associated larval and pupal skins and genitalia slide (MEX 610-13), same data as holotype [USNM]. *Paratypes:* 3 F (MEX 592), same locality as holotype, 21 July 1970, K. and D. Schroeder; 1 lpF (MEX 602-11), 5 L (MEX 602), same data as holotype; 4 F (MEX 607), same data as holotype, 1 L (MEX 608), same data as holotype; 2 lpM (MEX 609-12,15), 2 lpF (MEX 609-13,14), 4 L (MEX 609), same data as holotype; 1 lpM (MEX 610-10,11,12,15), 1 lpF (MEX 610-14), 22 L (MEX 610), same data as holotype [UCLA, BM, ISET].

**FEMALE** (fig. 13). Wing: 2.90 mm. Proboscis: 1.90 mm. Forefemur: 1.65 mm. Abdomen: 2.40 mm. **Thorax:** Dorsocentral line of white scales usually incomplete, broadened laterally and terminating at level of prescutal suture and usually double posteriorly as posterior dorsocentral line and supraalar line; white scales present above paratergite. **Legs:** Knee spots of white scales present posteriorly on apices of femora. **Abdomen:** Terga II-VI or VII with complete basal bands of white scales.

**MALE** (fig. 13). Wing: 2.10 mm. Proboscis: 1.60 mm. Forefemur: 1.20 mm. Abdomen: 1.90 mm. **Thorax:** Scutal scale pattern indistinct; white scales more extensive than in female, occasionally covering entire scutum. **Legs:** Posterior claw of midleg small, with acute subbasal tooth. **Abdomen:** Terga with basal bands of white scales.

**MALE GENITALIA** (fig. 13). **Segment IX:** Anterior middorsal emargination of



tergum broad and shallow, caudal bridge connecting tergal lobes broad; tergal lobes about as broad as high, with 3-6 setae. **Sidepiece:** Length 4 times median width; tergal surface with few short setae and usually 3 subapicotergal setae; sternomesal margin with about 30 moderately long setae; apical tergomesal lobe well developed; basal tergomesal lobe moderately well developed, triangular with posterior side longer than anterior side, often folded ventrad in slide preparations, with about 20 setae. **Claspette:** Stem broadly curved dorsad, slightly broadened distally; filament subequal in length to stem, narrow at base, abruptly expanded near middle with sharp retrorse process and several elongate spicules basad of retrorse process, and tapered to recurved tip. **Clasper:** Spiniform length about 10-14 times its greatest width. **Phallosome:** Aedeagus pyriform to ovate.

**PUPA** (fig. 13). Abdomen: 2.35 mm. Trumpet: 0.35 mm. Paddle: 0.70 mm. **Cephalothorax:** Weakly pigmented, dorsum only slightly darker. **Abdomen:** Weakly pigmented, only slightly darker anteriorly. Seta 3-V-VII single (3-VI, VII rarely double). Seta 5-IV-VI slightly longer than length of succeeding tergum, 5-IV usually single (single or double), 5-V, VI always single.

**LARVA** (fig. 14). Head: 0.80 mm. Siphon: 0.70 mm. Anal Saddle: 0.30 mm. **Thorax:** Spicules of integument moderately numerous and conspicuous, length about 6-10 times basal diameter. Seta 3-P single. Seta 7-P triple (2-3b). **Abdomen:** Seta 1-IV usually 4(3-4) branched; seta 1-V triple (2-3b). Seta 6-I usually triple (2-3b); seta 6-II-VI usually double (6-II 2-4b, 6-VI 1-2b). Seta 13-III strongly developed, triple (3-5b), subequal to seta 13-IV, V which are also triple (2-4b). **Segment VIII:** Comb scales moderate in size, usually with moderately differentiated median spinule, about 23(15-28) in number, in irregular double to triple row. **Siphon:** Index about 2.25-2.40. Pecten with teeth evenly spaced, extending slightly beyond middle of siphon. Seta 1-S inserted slightly distad of pecten. **Anal Segment:** Ventral brush (4-X) with 7 pairs of setal tufts, most proximal tuft often arising from saddle margin.

**SYSTEMATICS.** *Aedes atactavittatus* can be separated from the other species of the Scapularis Group by the following characters: in the **female** (1) the dorsocentral line of light scales on the scutum is broken for a short distance at the level of the prescutal suture and double posterior to the break and (2) knee spots of white scales are present on the apices of the femora; in the **male genitalia** (1) the claspette filament has a large retrorse process and several elongate spicules basad of the process and (2) the sternomesal margin of the sidepiece has about 30 setae between the basal tergomesal lobe and the clasper; in the **larva** seta 6-I is usually triple and 6-II-VI usually double.

This species is well marked in the larva, similar to *trivittatus* but with discrete scutal markings in the female, and more or less intermediate between *angustivittatus* and *trivittatus* in the male genitalia. It appears to be a relict of an early isolate of the Trivittatus Subgroup.

**BIONOMICS.** *Aedes atactavittatus* was collected at the type locality, an acacia-thorn scrub forest, in the larval stage from 4 small rockholes, all in the yards of dwellings. The water in each was temporary and either contained grassy vegetation or the surface was covered with sticks and leaves. Other species associated with *atactavittatus* were *Psorophora* (J.) *cyanescens*, *Culex* (C.) *coronator*, *C. (C.) corniger*, *C. (C.) nigripalpus* and *C. (Mel.) pilosus*. The Hopelchen larval collection was from a large, semipermanent, roadside ground pool containing grassy vegetation and floating sticks and bark, and larvae of *scapularis*, *C. pilosus* and *P. (J.) ferox*. Biting females were captured at the type locality on 2 occasions, once at 1600 hours (MEX



607) and once at 1700 hours (MEX 592).

DISTRIBUTION (fig. 2). *Aedes atactavittatus* is known only from two localities near Campeche, Campeche, Mexico. Material examined: 82 specimens; 9 males, 12 females, 14 pupae, 47 larvae; 14 individual rearings (larval).

MEXICO. Campeche: Hopelchen (20 km W on hwy 180), 80 m, 4 Aug 1970, K. and D. Schroeder (MEX 600), 2 lpM (10,11), 1 L [UCLA]. Lerma, type series, see above.

### 5. *Aedes (O.) meprai* Martinez and Prosen

Figs. 2,32

1953. *Aedes (Ochlerotatus) meprai* Martinez and Prosen, 1953:1-2. TYPE: *Holotype* female, Reserva Nac. "Finca El Rey," Dep. Anta, Salta, Argentina, Nov 1952 [BA]. Synonymy with *angustivittatus* by Ronderos and Garcia (1963b:38).

*Aedes (Ochlerotatus) meprai* of Stone, Knight and Starcke (1959:148); Forattini (1965:364).

*Aedes (Ochlerotatus) angustivittatus* of Cerqueira (1943:31); Ronderos and Garcia (1963a:37); Forattini (1963:348, in part); Stone (1967:207).

*Aedes angustivittatus* of Del Ponte, Castro and Garcia (1951:236).

FEMALE (fig. 32). Wing: 4.40 mm. Proboscis: 2.55 mm. Forefemur: 2.40 mm. Abdomen: 2.90 mm. Thorax: Dorsocentral line of white scales expanded laterally in antealar and supraalar areas, with elongate patch of dark scales laterad of posterior dorsocentral line; white scales present above paratergite. Legs: Knee spots of white scales absent posteriorly on apices of femora. Abdomen: Terga entirely dark scaled dorsally.

MALE, PUPA, LARVA. Unknown.

SYSTEMATICS. I have seen *meprai* only in the female, and although similar to *trivittatus* and *angustivittatus*, it can be distinguished from *trivittatus* by the absence of knee spots of white scales on the apices of the femora and from *angustivittatus* by the light dorsocentral line of white scales on the scutum which is expanded laterally in the antealar and supraalar areas.

This species has been known only from the type locality; however, I have seen females from 2 localities in southern Bolivia, an unknown locality probably in Peru and from a single locality in southern Ecuador, all indistinguishable from the paratype I have seen from Argentina. This indicates a possible continuous distribution from Ecuador through Peru and Bolivia to northern Argentina, probably at moderate to high elevations. The Ecuador collection is from 2000 meters elevation, and, in contrast, the closely related *angustivittatus* has been collected in Ecuador only at low elevations on the Pacific Coast.

BIONOMICS. The type series of *meprai* was collected biting man. No more is known of the bionomics of this species.

DISTRIBUTION (fig. 2). *Aedes meprai* is known from northern Argentina, southern Bolivia, southern Ecuador and Peru. Specimens examined: 15 specimens; 15 females.

ARGENTINA. Salta: Reserva [Parque] Nacional Finca el Rey, Nov 1952, Martinez, 1 F [INM].

BOLIVIA. Chuquisaca: Muyapampa, 3 Apr 1944, Carr (3147), 1 F [USNM]. Santa Cruz: Camira, 23 Apr 1944, Carr (3148), 3 F [USNM].

ECUADOR. Loja: Vilcabamba (20 km S Loja), 2000 m, 17 May 1974, D. Pletsch (ECU 186), 7 F [UCLA].

PERU. [?] Otapampa, 3 Aug 1927, C. Townsend, 3 F [USNM].



6. *Aedes (O.) angustivittatus* Dyar and Knab

Figs. 2,15,16

1907. *Aedes angustivittatus* Dyar and Knab, 1907:9. TYPE: *Holotype* female, Limon, Limon, Costa Rica, 28 Sept 1905, F. Knab [USNM, 10140; see Stone and Knight, 1956:214]. Synonymized with *trivittatus* by Dyar (1922a:52); resurrected from synonymy with *trivittatus* by Dyar (1924a:117).
1908. *Aedes cuneatus* Dyar and Knab, 1908:54-55. TYPE: *Lectotype* female (422.19) with associated 2 larval and 1 pupal skins, Cordoba, Veracruz, Mexico, 20 Jan 1908, F. Knab [USNM, 11964, selection of Stone and Knight, 1956:216]. Considered a subspecies of *trivittatus* by Dyar (1922a:54); synonymy with *angustivittatus* by Dyar (1924a:117).
1908. *Aedes argentescens* Dyar and Knab, 1908:55. TYPE: *Lectotype* male (441.4), Cordoba, Veracruz, Mexico, 20 Jan or 8 Apr 1908, F. Knab [USNM, 11965; selection of Stone and Knight, 1956:214]. Synonymy with *cuneatus* by Howard, Dyar and Knab (1917:770).
1925. *Aedes traversus* Dyar, 1925b:215-216. TYPE: *Lectotype* female, sand bar in Zulua River, Zulua, Venezuela, L. H. Dunn [USNM, 28480; selection of Stone and Knight, 1956:226]. Synonymy with *angustivittatus* by Dyar (1928:163).

*Aedes (Ochlerotatus) angustivittatus* of Dyar (1925a:144; 1928:163-164); Edwards (1932:142); Lane (1939:107; 1953:670-671); Arnett (1949:237); Vargas (1956:22); Stone, Knight and Starcke (1959:138); Forattini (1965:347-349, in part); Stone (1967:207, in part).

*Aedes (Heteronychia) angustivittatus* of Dyar (1920:105).

*Aedes angustivittatus* of Howard, Dyar and Knab (1917:776-778); Dyar (1924a:117-118); Kumm, Komp and Ruiz (1940:399); Kumm and Zuniga (1942:404).

*Aedes (Ochlerotatus) angustivittatus angustivittatus* of Martini (1935:4).

*Aedes (Heteronychia) cuneatus* of Dyar (1920:105).

*Aedes cuneatus* of Howard, Dyar and Knab (1917:770-773); Dyar (1918a:77).

*Aedes (Ochlerotatus) angustivittatus cuneatus* of Martini (1935:54).

*Aedes (Ochlerotatus) trivittatus cuneatus* in part of Dyar (1922a:52).

*Aedes (Ochlerotatus) trivittatus* of Dyar (1918a:77; 1922a:52, in part; 1923:181); Bonne and Bonne-Wepster (1925:392-393, in part).

*Aedes (Heteronychia) trivittatus* in part of Dyar (1922b:51-52).

*Aedes trivittatus* of Evans (1921:446; 1922:220).

**FEMALE** (fig. 15). Wing: 3.40 mm. Proboscis: 2.15 mm. Forefemur: 1.65 mm. Abdomen: 3.10 mm. **Thorax:** Dorsocentral line of light scales complete, unbroken from anterior promontory to scutellum; line narrow, broadened only slightly posteriorly, almost never expanded into supraalar area; scales yellow, rarely light yellow to white. **Legs:** Knee spots of white scales absent posteriorly on apices of femora. **Abdomen:** Terga entirely dark scaled dorsally.

**MALE** (fig. 15). Wing: 3.40 mm. Proboscis: 2.20 mm. Forefemur: 1.50 mm. Abdomen: 3.15 mm. **Thorax:** Scutal scale pattern similar to female; longitudinal line of light scales rarely broadened laterally. **Legs:** Posterior claw of midleg moderately enlarged, with acute subbasal tooth. **Abdomen:** Terga dark scaled dorsally.

**MALE GENITALIA** (fig. 15). **Segment IX:** Anterior middorsal emargination of tergum broad and deep, caudal bridge connecting tergal lobes narrow, less than distance between lobes; tergal lobes usually higher than broad, with about 4-6(2-10) setae. **Sidepiece:** Length about 4.0-4.5 times median width; tergal surface with 5-6 large subapicotergal setae in oblique row; sternomesal margin with 40-50 long setae; apical tergomesal lobe well developed; basal tergomesal lobe well developed, triangu-



lar with posterior side shorter than anterior side, lobe often folded ventrad in slide preparations, with 15-25 undifferentiated setae, those on margin of cluster longer, with 4 longer setae projecting distad from posterior edge of lobe. **Claspette:** Stem broadly curved dorsad, narrow basally and broadened into calyciform apex from which the filament arises; filament shorter than stem, narrow at base, abruptly expanded near middle with sharp retrorse process and several elongate spicules basad of retrorse process, and tapered to recurved tip. **Clasper:** Spiniform length about 7-10 times its greatest width. **Phallosome:** Aedeagus ovate to pyriform.

**PUPA** (fig. 15). Abdomen: 2.75 mm. Trumpet: 0.45 mm. Paddle: 0.80 mm. **Cephalothorax:** Weakly pigmented, dorsum slightly darker. Seta 10-C usually 5-7 (4-9) branched. **Abdomen:** Weakly pigmented, slightly darker anteriorly, strongly pigmented at base of segment III. Seta 3-VII double or triple (1-5b). Seta 5-IV,V longer than length of succeeding tergum, usually double. Seta 6-IV double or triple (1-4b); seta 6-V double (rarely single).

**LARVA** (fig. 16). Head: 0.90 mm. Siphon: 0.90 mm. Anal Saddle: 0.40 mm. **Thorax:** Spicules of integument numerous and conspicuous, length about 6-10 times basal diameter. Seta 3-P single. Seta 7-P triple (2-3b). **Abdomen:** Seta 1-IV usually double (2-3b); seta 1-V double (1-3b). Seta 6-I double (1-2b); seta 6-II double (2-3b); seta 6-III-VI single (1-2b). Seta 13-III strongly developed, single, subequal to seta 13-IV,V. **Segment VIII:** Comb scales moderate in size, evenly fringed, 20-24(16-29) in number, in irregular double to triple row. **Siphon:** Index about 2.0-2.5. Pecten with teeth evenly spaced, extending slightly beyond middle of siphon. Seta 1-S inserted distad of pecten. **Anal Segment:** Ventral brush (4-X) with 8 pairs of setal tufts, the most proximal tuft occasionally arising from within saddle.

**SYSTEMATICS.** *Aedes angustivittatus* can be separated from the other species of the Scapularis Group by the following characters: in the **female** (1) the narrow dorsocentral line of usually yellow, occasionally yellowish white, scales on the scutum is broadened only very slightly posteriorly and (2) there are no knee spots of white scales on the apices of the femora; in the **male genitalia** (1) the claspette stem is expanded into a cup-like apex from which the claspette filament arises, (2) the spiniform is short, only about 7 to 10 times longer than wide, and (3) the subapico-tergal setae number 5 or 6 in an oblique row; in the **larva** (1) seta 1-IV,V is usually double, (2) setae 5,6-C are single, (3) seta 6-I is double and 6-II-VI are single, (4) the comb scales have all spinules subequal, and (5) the spicules of the thoracic and abdominal integument are long, length 6-10 times basal diameter.

I have seen 158 specimens consisting of 29 males, 72 females, 17 pupae and 40 larvae (13 individual rearings; 6 larval, 6 pupal, 1 incomplete) from several localities in Mexico and 1 locality in Guatemala that I consider to be hybrids between *angustivittatus* and *trivittatus*, and it is evident that a much more thorough study of these 2 species is required in the area where their ranges overlap. The 2 species are allopatric except for an area of Mexico from the states of Jalisco and central Veracruz on the north to Oaxaca on the south. Since *angustivittatus* appears to be more abundant and better established than *trivittatus* in this area, it may indicate a relatively recent southern invasion by *trivittatus*. The mixing of the gene pools of numerically dissimilar populations would result in introgressive hybridization, and extensive backcrossing of the hybrids with the dominant form, *angustivittatus*, would prevent the formation of a stable hybrid population. According to Mayr (1973:370, 380), populations meeting in zones of secondary intergradation (a belt of highly variable hybrid populations) may show any degree of difference, which is evident in the



females and male genitalia of the hybrids I have seen.

Females of *angustivittatus* differ from *trivittatus* in scutal ornamentation, the dorsocentral light lines being narrow, usually yellow and not broadened posteriorly in *angustivittatus* and wider, usually white, and usually broadened laterally above the wing in *trivittatus*; knee spots of white scales on the apices of the femora are absent in *angustivittatus* and present in *trivittatus*; and the abdominal terga are entirely dark dorsally in *angustivittatus* and usually have basal bands of white scales in *trivittatus*. Hybrids exhibit a usually white scutal stripe broader than *angustivittatus* and often as broad as *trivittatus* and the dark femoral apices and dark dorsal abdomen typical of *angustivittatus*.

The male genitalia of *angustivittatus* differ from *trivittatus* primarily in the following characters: (1) the subapicotergal setae number 5 or 6 in an oblique row in *angustivittatus* and usually 3 in *trivittatus*, (2) the claspette stem is expanded into a cup-like apex in *angustivittatus* and not expanded in *trivittatus*, (3) the spiniform length is 7 to 10 times longer than wide in *angustivittatus* and 12 to 14 times longer than wide in *trivittatus*, and (4) the basal tergomesal lobe is smaller in *angustivittatus*, has a tendency to fold ventrad in slide preparations and the posterior side is shorter than the anterior side, while in *trivittatus* the anterior and posterior sides are subequal and the lobe is larger and seldom folded. The hybrids exhibit a combination of these characters, most often the sidepiece characteristics of *angustivittatus* and the claspette and spiniform of *trivittatus*. A male from near Mixco, Guatemala (GUA 115B) is *trivittatus*-like in all respects although all other specimens from south of Oaxaca, Mexico are typical *angustivittatus*.

A large series of specimens was collected by Frederick Knab at Cordoba, Veracruz, Mexico from which Dyar and Knab (1908:54-55) described *cuneatus* and *argentescens*, both later (Dyar, 1924a:117) synonymized with *angustivittatus*. Although this series of males and females consists of both *angustivittatus* and hybrids, the lectotype female of *cuneatus* and the lectotype male of *argentescens* are *angustivittatus*. In the females of this series, the dorsocentral stripe of the scutum is light yellow in both forms but the stripe is narrow in *angustivittatus* and much broader in the hybrid. The male genitalia show the *angustivittatus* and hybrid characters discussed above.

**BIONOMICS.** *Aedes angustivittatus* is one of the most common *Aedes* in Central America, being found in temporary ground pools formed by rains and stream overflow, pools in drying or intermittent streams, animal hoof prints in marshy pastures and margins of freshwater swamps and ponds. It is found with a variety of species of *Psorophora*, *Culex* and other *Aedes*, and occasionally with species of *Anopheles*. Although collected at elevations of over 2000 meters in Mexico and over 1000 meters in Venezuela and Costa Rica, it is primarily a species of low elevations. Kumm, Komp and Ruiz (1940:392) found *angustivittatus* to be the third most common non-anopheline species taken as adults in traps or by animal bait during a survey in Costa Rica, totaling 10.5% of 5338 captures and ranking behind only *Culex* (*C.*) *quinquefasciatus* and *Mansonia* (*M.*) *titillans*.

Ilheus virus and Venezuelan equine encephalitis virus have been isolated from *angustivittatus* and are discussed above under Medical Importance.

**DISTRIBUTION** (fig. 2). *Aedes angustivittatus* is known from the Mexican states of Jalisco, Distrito Federal and Veracruz south through Central America to Colombia, Venezuela and Ecuador. Material examined: 4152 specimens; 621 males, 2807 females, 256 pupae, 468 larvae, 112 individual rearings (77 larval, 29 pupal, 6 incomplete).



**BELIZE.** **Belize:** Stann Creek (23 mi W), 1 F [USNM]. **Cayo:** Central Farm, 70 m, 30 July 1967, D. Bertram (BH 360), 1 F [UCLA]; same locality and collector, 17 Aug 1967 (BH 479), 1 F [UCLA]. Mountain Pine Ridge, 10 Aug 1967, P. Williams (BH 490), 2 F [UCLA]. New Capital Site, 70 m, 28 July 1967, D. Bertram (BH 350), 1 F [UCLA]. Roaring Creek, 55 m, 24 July 1967, D. Bertram (BH 324-326), 1 F [UCLA]; same locality and collector, 9 Aug 1967 (BH 429), 1 F [UCLA].

**COLOMBIA.** **Caldas:** La Dorada, 25 June 1943, W. Komp (KO 200-10), 18 M, 2 F [UCLA]; same locality and collector, 1944 (KO 202C-7), 20 F [UCLA]. **Choco:** Atrato River, A. Balfour, 2 M, 2 F [BM]. **Cundinamarca:** Puerto Lievano [?] and Bogota, 6 Aug 1965, B. Amartegui, 1 F [USNM]. **Magdalena:** Cienaga, 11 Jan 1944, A. Barreto (COT 36), 1 F [UCLA]. **Meta:** Retiro (nr. Restrepo), 6, 12 Nov 1935, 2 M [USNM]. **Santander:** Lebrija, 10 Apr 1966, C. Marinkelle (COM 64A), 4 F [UCLA]; same data (COM 64C), 5 F [UCLA]. **Locality unknown:** (COR 506), 1 F [UCLA]; (COR 497), 1 F [UCLA].

**COSTA RICA.** **Alajuela:** Cascajal, H. Kumm, 1 F [BM]. Ciruelas, 14 Nov 1920, A. Alfaro, 1 F [USNM]. San Ramon, 1000 m, 12 Aug 1971, S. Heinemann (CR 340), 1 lpF (10), 1 pM (102), 2 pF (100,104), 1 p [UCLA]; same data (CR 342), 1 lpF (10), 1 pM (100), 1 l [UCLA]. **Cartago:** El Empalme, 16 July 1963, C. Hogue (CR 154), 3 lpM (104,106,109), 5 lpF (101,102,107,108,110), 14 M, 10 F, 4 p, 15 P, 5 l, 41 L [UCLA]. Turrialba, 9 Aug 1962, F. Truxal, 1 F [UCLA]. Turrialba, 1 Dec 1962, C. Hogue and W. Powder (CR 57), 2 F [UCLA]; same data (CR 60), 8 F [UCLA]; same locality and collectors, 2 Dec 1962 (CR 64), 3 F [UCLA]; same locality, 8 Dec 1962, C. Hogue, 1 F [UCLA]; same locality, 606 m, June 1954, P. Buxton, 1 F [BM]. **Guanacaste:** Liberia (2 km W), 27 July 1962, F. Truxal, 2 F [UCLA]. **Heredia:** Pto. Viejo de Sarapiquí, 7 Aug 1971, A. Berrios Arias (CR 408), 1 F [UCLA]; same locality, 8 Aug 1971, S. Heinemann (CR 421), 2 F [UCLA]; same locality and date, D. Heinemann (CR 427), 1 F [UCLA]. **Limon:** Beverly, 10 m, 15 Dec 1971, D. and K. Schroeder (CR 558), 6 L [UCLA]. Boston, 46 m, 9 Oct 1971, D. Schroeder (CR 487), 3 pM (102-104), 1 pF (101), 1 P [UCLA]. Estrada, 46 m, 8 Oct 1971, D. Schroeder (CR 482), 5 lpM (13-15,17,71), 20 lpF (11,12,16,18,19,60-70,72-75), 1 pM (100), 3 pF (101-103), 1 lp (10), 22 M, 22 F, 31 p, 86 P, 3 l, 30 L [UCLA]. La Bomba (3.7 km W), 3 Oct 1971, D. and K. Schroeder, 1 F [UCLA]. Limon, 28 Sept 1905, F. Knab, 1 F (*angustivittatus* holotype) [USNM]. Pueblo Nuevo, 14 Dec 1971, D. Schroeder (CR 548), 1 F [UCLA]. Siquirres, H. Kumm, 1 F [BM]. Zent, F. Knab, 1 M, 4 F [USNM]. Zent (0.3 km N), 46 m, 8 Oct 1971, D. Schroeder (CR 485), 2 lpM (12,13), 2 lP (10,11), 6 L [UCLA]. Zent (½ dist. to Boston), 15 m, 12 Dec 1971, D. and K. Schroeder (CR 540), 2 F, E [UCLA]. Zent, L. Rozeboom, 1 F [UCLA]. **Puntarenas:** Boca del Rio Barranca, 7 m 14 Aug 1971, D. Schroeder (CR 373), 1 F [UCLA]; same locality, 20 June 1963, C. Hogue (CR 108), 5 F [UCLA]. Dominical, 28 May 1943, T. Aitken (CRM 19), 5 F [UCLA]; same locality and collector, 22 June 1943 (CRM 24), 2 F [UCLA]. Esparta, 1938, H. Kumm (KO H14-27), 1 F [UCLA]. Golfito, 9 July-21 Aug 1957, F. Truxal, A. Menke (CR 172), 1 F, 1 l, 21 L [UCLA]. Rio Aranjuez, F. Knab, 2 F [USNM]. San Vito de Java, 22-24 July 1964, R. Woodruff (CRM 32), 1 M, 10 F [UCLA]. **San Jose:** San Jose, 13 June 1963, C. Hogue (CR 92), 11 F [UCLA]; same data (CR 94), 1 F [UCLA]; same locality and collector, 16 June 1963 (CR 95), 1 F [UCLA]. **Province unknown:** [?] Chase, 1938, H. Kumm (CRK 218), 1 M, 1 F [UCLA]. **Locality unspecified:** 4 F [BM].

**ECUADOR.** **Guayas:** Empalme (3 km S), 6 Feb 1966, J. Belkin et al. (ECU 120), 1 F [UCLA]. Guayaquil, 15 Feb 1966, E. Gerberg (ECU 172), 7 F [UCLA]. Pichilingue, 16, 17 Mar 1946, E. Hambleton, 6 F [USNM]. Samborondon, 10 Feb 1966, J. Belkin (ECU 138), 4 M, 12 F [UCLA]. **Los Rios:** Valencia, 6 Feb 1966, J. Belkin et al. (ECU 122), 1 F [UCLA].

**EL SALVADOR.** **La Libertad:** Atiocoyo, Oct 1941, 2 M [USNM]. **San Miguel:** San Miguel, 1 F [USNM]. **Sonsonate:** Sonsonate, F. Knab, 5 P [USNM].

**GUATEMALA.** **Escuintla:** Iztapa, 10 July 1964, P. Cowsill (GUA 34), 4 F [USNM]. San Jose de Guatemala (Puerto de San Jose), 17 July 1943, D. Hall (KO 204A-14), 2 F [UCLA]. Santa Lucia Cotzumalguapa, 3 July 1964, T. Zavortink and P. Cowsill (GUA 31), 3 F [UCLA]. **Guatemala:** Guatemala, 2 Sept 1964, P. Cowsill and Almengor (GUA 119), 4 lpF (10-13), 1 lp (14) [UCLA]. Mixco, 1700 m, 1 Sept 1964, P. Cowsill and Almengor (GUA 115B), 1 lpM



(63), 3 lpF (61,62,64), 1 lp (60), 1 M [UCLA]. Izabal: Bananera, 26 June 1964, P. Cowsill (GUA 4), 1 F [UCLA]; same locality, 11 Aug 1964, T. Zavortink (GUA 114), 6 F [UCLA]. Mojaca Village, 28 June 1964, J. Zavortink and P. Cowsill (GUA 12), 2 F [UCLA]. Morales, 30 July 1963, T. and J. Zavortink (GUA 73), 1 F [UCLA].

HONDURAS. **Atlantida:** La Ceiba, 6 m, 7 Feb 1972, D. Schroeder (HON 114), 1 F [UCLA]. Lancetilla, 9 Feb 1972, K. and D. Schroeder (HON 121), 2 F [UCLA]; same data (HON 122), 3 pM (106-108), 2 pF (105,109) [UCLA]; same data (HON 123), 6 pM (100,102-104,107,109), 3 pF (101,106,108), 21 [UCLA]. Rio Nutria (0.8 km E on road from Tela to La Ceiba), 70 m, 8 Feb 1972, D. Schroeder (HON 116), 1 F [UCLA]. Tela (2.5 km NW), 2 m, 9 Feb 1972, D. Schroeder (HON 118), 6 lpM (14,16,19,20), 11 lpF (11-13,15,18,21,23,25-28), 1 M [UCLA]. Tela, 13 Aug 1964, P. Cowsill (HON 27), 1 F [UCLA]. **Cortes:** La Lima, 5 Aug 1964, P. Cowsill (HON 1), 1 F [UCLA]. Puerto Cortes, 12 Aug 1967, A. Adames (HON 67), 1 F [UCLA]. San Pedro Sula (21 km N), 11 Aug 1967, A. Adames (HON 65), 3 F [UCLA].

MEXICO. **Distrito Federal:** Mexico City, 1919, A. Herrera, 1 F [USNM]; same locality and collector, 21 June 1926, 1 F [USNM]. **Guerrero:** El Marquez, 30 Aug 1964, E. Fisher and D. Verity (MEX 143), 1 F [UCLA]; same data (MEX 140), 1 F [UCLA]. **Jalisco:** Puerto Vallarta, 15 m, 31 Aug 1972, J. Belkin (MEX 726), 4 M, 3 F [UCLA]. **Morelos:** Tepotzlan (8.2 km W), 1600 m, 28 June 1970, K. and D. Schroeder (MEX 511), 4 lpM (10-13) [UCLA]. **Tabasco:** Cardenas, 30 m, 15 July 1970, K. and D. Schroeder (MEX 564), 1 F [UCLA]. Comalcalco (7.5 km N), 36 m, 12 July 1970, K. and D. Schroeder (MEX 552), 1 F [UCLA]. **Veracruz:** Cordoba, 20 Jan or 8 Apr 1908, F. Knab, 6 M, 3 F (440.1); 1 M, 1 F (440.2); 1 M, 1 F, 2 p, 21 (441.1); 3 M, 1 F, 3 l (441.2); 1 M (441.3); 6 M, 6 F (441.4); 1 M, 5 F (441.5); 1 M (425.1); 1 M (425.2); 1 F (425.3); 1 M (425.4), 1 M (425.5); 1 F (425.6); 1 F (425.7); 1 M, 2 F, 2 l (425.8); 1 M, 3 F (425.9); 1 F (425.11); 1 M (441.4, *argentescens* lectotype); 1 l,lpF (422.19, *cuneatus* lectotype) [USNM]. Cordoba, 9 Aug 1965, D. Schroeder and S. Law (MEX 281), 1 F [UCLA]; same data (MEX 284), 3 F [UCLA]. Cordoba, 915 m, 11 July 1964, C. Hogue (MEX 376), 3 M, 2 F [UCLA]. Ixhuatlan-Cordoba (3 km S), 1330 m, 8 July 1970, K. and D. Schroeder (MEX 533), 6 M, 11 F [UCLA]. Jesus Carranza (Santa Lucrecia), F. Knab, 14 F [USNM].

NICARAGUA. **Comarca de El Cabo:** San Carlos (on Rio Segovia) (KO H21-24), 1 F [UCLA]. **Leon:** Isla Penas Blancas, nr. Puerto Somoza, 16 June 1964 (NI 13), 17 F [UCLA]. Puerto Somoza, 18 June 1964 (NI 20), 1 F [UCLA]. **Zelaya:** Bluefields, 60 m, 23 Nov 1971, D. and K. Schroeder (NIC 84), 2 F [UCLA]; same locality and collectors, 8 m, 24 Nov 1971 (NIC 89), 1 F [UCLA]. El Recreo, 29 June 1954, K. Neiland, 8 F [UCLA]. Punta Masalla (4 km S Bluefields), 1 m, 27 Nov 1971, D. and K. Schroeder (NIC 113), 1 F [UCLA].

PANAMA AND CANAL ZONE. **Bocas del Toro:** Almirante, Feb 1931 (PAX 22), 3 M, 1 F [UCLA]. Almirante, July 1934 (PAX 41), 7 M [UCLA]. Almirante, 19 Aug 1944, W. Komp (KO 200-29), 2 F [UCLA]; same locality and collector, 24 Aug 1944 (KO H21-29), 1 F [UCLA]. Almirante, 27 Apr 1963 (PA 269), 1 F [UCLA]. Almirante, 28 Apr 1963 (PA 270), 252 M, 415 F [UCLA]. Almirante, 30 Apr 1963 (PA 294), 20 F [UCLA]. Almirante, 2 May 1963 (PA 304), 23 M, 247 F [UCLA]. Almirante, 3 May 1963 (PA 305), 1 F [UCLA]. Almirante, 3 May 1963 (PA 308), 36 M, 712 F [UCLA]. Almirante, 3 May 1963 (PA 309), 3 F [UCLA]. Almirante, 5 May 1963 (PA 321), 4 M, 467 F [UCLA]. Almirante, 7 May 1963 (PA 331), 2 M, 10 F [UCLA]. Almirante, 8 May 1963 (PA 338), 5 F, 321 M [UCLA]. Almirante, 15 Apr 1964 (PA 670), 185 L [UCLA]. Chiriqui Grande, 17 Apr 1963 (PA 220), 6 F [UCLA]; same locality, 19 Apr 1963 (PA 243), 2 F [UCLA]. Chiriquisito, 15 Apr 1963 (PA 207), 10 F [UCLA]. Chiriquisito, 16 Apr 1963 (PA 208), 12 F [UCLA]. Chiriquisito, 16 Apr 1963 (PA 217), 2 lpM (102,106), 4 lpF (101, 103,105,107), 1 lp (104), 1 P, 67 L [UCLA]. Chiriquisito, 18 Apr 1963 (PA 226), 16 F [UCLA]. Chiriquisito, 19 Apr 1963 (PA 237), 20 F [UCLA]. Chiriquisito, 22 Apr 1963 (PA 249), 1 M, 2 F [UCLA]; same data (PA 250), 18 M [UCLA]. **Canal Zone:** Albrook Field, W. Komp, 1 F [UCLA]. Albrook Field (PA 743-C), 1 F [UCLA]. Cocoli, June 1946, C. Pierce, 1 F [UCLA]. Ft. Davis, 7 Nov 1951, S. Carpenter, 16 F [UCLA]. Ft. Davis, 22 Nov 1966, R. Schick and A. Quinonez (PA 813), 2 F [UCLA]. Ft. Kobbe, 26 Nov 1951, S. Carpenter, 2 F [UCLA]. Ft. Sherman, 23 Nov 1939, W. Komp (KO 202C-9), 2 F [UCLA]. Gatun, 9 Aug 1923, H. Dyar and R. Shannon, 3 F [UCLA]. Gatun [?] Tarpon, 12 Dec 1951, S. Carpenter, 5 F [UCLA]. Las



Cascadas (3 km SE Gamboa), A. Busck, 1 M [BM]. Madden Dam, 27 Oct 1948, 1 F [UCLA]. Madden Dam, 13 Aug 1949, 1 F [UCLA]. Matachin (1 km SW Gamboa), 29 June 1913, J. Zetek, 2 M [USNM]. Pedro Miguel, 22 Apr 1947, H. Brooks, 2 M, 2 F [UCLA]. Tabernilla (12 km W Gamboa), 12 May 1908, A. Jennings, 1 F [UCLA]; same locality and collector, 2 F [BM]. Locality unspecified (CZ 49), 1 M [UCLA]. **Chiriqui:** David, 6 June 1943, F. Snyder (KO 202A-29), 2 F [UCLA]. **Colon:** Colon, L. Dunn, 1 F [UCLA]. Colon, 27 July 1920, W. Chidester, 3 F [USNM, UCLA]. Colon, 18 June 1929, D. Curry (PAX 3), 2 F [UCLA]; same locality and collector, 10 Jan 1930 (PAX 13), 1 M [UCLA]. Rio Alejandro (4 km N Puerto Pilon), 14 Feb 1940, W. Komp, 3 F [UCLA]. **Darien:** El Real, 25 May 1936, L. Rozeboom (PAR 34), 1 F [UCLA]. **Panama:** Huile, 23 Nov 1965, A. Quinonez (PA 834), 1 pM (50), 1 pF (101), 5 M, 1 L, 5 L [UCLA]. La Chorrera, 14 Aug 1944, Wood and Van Doran (ASM 95), 1 M, 3 F [UCLA]. La Chorrera, 21 Aug 1944 (ASM 124), 2 F [UCLA]. La Chorrera, 26 Sept 1944, P. Adams (ASM 171), 5 F [UCLA]. Tocumen, 10 m, 27 July 1972, H. Arnell (PA 1147), 2 lpM (40,41), 1 L [UCLA]. Tocumen, 11 Sept 1963 (PA 553), 2 F [UCLA]. **Province unknown:** [?] Alhajuelo, 17 Apr 1911, A. Busck, 15 F [UCLA]. **Locality unknown:** 8 Sept 1934, L. Rozeboom (PAR 63), 2 F [UCLA].

**VENEZUELA.** **Aragua:** Cagua, 400 m, 12 Aug 1969, J. Valencia and J. Pulido (VZ 344), 1 F [UCLA]. [La] Trinidad, 30 Jan 1929 (VZR 141), 14 M, 3 F [UCLA]; same data (VZR 162), 16 M, 2 F [UCLA]. Maracay, 20 Aug-25 Oct 1926, M. Nunez Tovar, 5 M, 9 F [UCLA], USNM; same locality and collector, 10 May 1927 (VZR 4), 2 F [UCLA]; same locality and collector, 3 July 1927, 1 M [USNM]. Maracay (VZR 242), 3 M [UCLA]. Maracay (VZR 247), 32 M, 22 F [UCLA]. Maracay (VZR 249), 16 M, 13 F [UCLA]. Ocumare de la Costa, 5 July 1927, M. Nunez Tovar, 1 F [USNM]; same locality, 5 July 1927 (VZR 14), 4 F [UCLA]. Palo Negro, 11 Dec 1967, J. Vera (VZ 112 ?), 1 M, 1 F [UCLA]. Rancho Grande (1.5 km S), Dec 1967, Hansell and Rauch (VZ 90), 1 pF (101), 3 F, 3 p [UCLA]. San Jacinto Mil. Res. (nr. Maracay), 550 m, J. Valencia and J. Pulido (VZ 242), 1 M [UCLA]; same locality, 30 Oct 1928 (VZR 83), 1 F [UCLA]; same locality, 27 Nov 1928 (VZR 98), 7 M [UCLA]; same locality, 12 Dec 1928 (VZR 103), 1 M [UCLA]; same locality, 19 Feb 1929 (VZR 150), 2 M, 2 F [UCLA]; same locality, 11 Mar 1929 (VZR 153), 1 M, 2 F [UCLA]; same locality, 13 Apr 1929 (VZR 168), 3 M [UCLA]; same locality, 3 July 1929 (VZR 212), 1 M [UCLA]; same locality, 1929, 3 M, 1 F [UCLA]. Turiamo, 11 Sept 1944, W. Komp, 2 M [UCLA]; same locality and collector, 14 Sept 1944 (KO 202A-10), 1 F [UCLA]. **Carabobo:** Lake Valencia, 29 Nov 1967, Hansell and Rauch (VZ 69), 2 lpF (11,12), 1 lp (10), 1 F, 2 L [UCLA]; same data (VZ 64), 1 F [UCLA]. **Portuguesa:** Acarigua (VZR 230), 3 F [UCLA]. **Zulia:** Zulia River, L. Dunn, 1 F [USNM]; same data, 1 F (*traversus* lectotype) [USNM].

#### Hybrids

**GUATEMALA.** **Guatemala:** Mixco, 1700 m, 1 Sept 1964, P. Cowsill and Almengor (GUA 115B), 1 M [UCLA].

**MEXICO.** **Morelos:** Tepotzlan (8 km W), 1600 m, 28 June 1970, K. and D. Schroeder (MEX 508), 1 lpF (10), 4 L [UCLA]; same data (MEX 509), 1 lp (10), 2 L [UCLA]; same data (MEX 511), 1 lpM (15), 1 lpF (14), 2 pM (101,102), 2 pF (100,104), 4 L [UCLA]. **Oaxaca:** Almoloya, F. Knab, 18 M, 15 F (309) [USNM]. Asuncion Nochixtlan (1.5 km SE), 24 Aug 1964, D. Verity (MEX 134), 19 L [UCLA]. Cameron (34 km SE), 21 Aug 1964, E. Fisher (MEX 133), 2 L [UCLA]. Matias Romero (42 km N, nr. Juchitan), 26 July 1963, E. Fisher (MF 13), 1 F [UCLA]. **San Luis Potosi:** Saketepan, 200 m, 20 July 1965, D. Schroeder (MEX 215), 5 F [UCLA]. **Veracruz:** Cordoba, 16 Mar 1908, F. Knab, 1 F [USNM]. Cordoba, 7 Aug 1965, D. Schroeder and S. Law (MEX 278), 2 lpM (9-10,11), 1 lpF (9-12), 4 M, 15 F, 3 p, 1 P, 1 L, 3 L [UCLA]; same locality and collectors, 9 Aug 1965 (MEX 281), 11 F [UCLA]; same data (MEX 282), 6 F [UCLA]; same data (MEX 283), 1 F [UCLA]; same data (MEX 284), 1 lpF (3-12), 1 pM (3-10), 1 pF (3-11), 5 F 21 [UCLA]. Cordoba, 915 m, 11 July 1965, C. Hogue (MEX 376), 3 F [UCLA]; same locality and collector, 12 July 1965 (MEX 378), 2 F [UCLA]. Jesus Carranza (Santa Lucrecia), F. Knab, 1 F [USNM].



7. *Aedes (O.) trivittatus* (Coquillett)

Figs. 2,17,18,19

1902. *Culex trivittatus* Coquillett, 1902:193-194. TYPE: *Holotype* female, Chester, New Jersey, USA, 10 or 14 Sept, J. B. Smith [USNM, 6702; see Stone and Knight, 1956:226].
1904. *Culex inconspicuus* Grossbeck 1904:333. TYPE: *Lectotype* male, Garret Mts., Paterson, New Jersey, USA, 5 Oct [USNM; selection of Stone and Knight, 1956:219]. Synonymy with *trivittatus* by Howard, Dyar and Knab (1917:773).

*Aedes (Ochlerotatus) trivittatus* of Dyar (1922a:52, in part; 1928:162-163); Root (1924:452); Bonne and Bonne-Wepster (1925:392-393, in part); Edwards (1932:143); Martini (1935:54); Matheson (1944:161-162); Ross (1947:75-76); Darsie (1951:21); Carpenter and La Casse (1955:249-251); Horsfall and Craig (1956:372); Vargas (1956:24); Barr (1958:109-110); Stone, Knight and Starcke (1959:156); Forattini (1965:329-331); Trimble (1972:1535).

*Aedes (Heteronychia) trivittatus* of Dyar (1920:105; 1922b:51-52).

*Aedes trivittatus* of Dyar and Knab (1906a:197); Howard, Dyar and Knab (1917:773-776); Dyar (1918a:77; 1924a:117); Shlaifer and Harding (1946:250); Weathersbee and Arnold (1947:218); Abdel-Malek (1948:951-954; 1949:19); Breland (1951:362); Judd (1954:107); Price (1960:558); Breland, Snow and Pickard (1961:293-294); Steward and McWade (1960:156-157); Horsfall, Vorhees and Cupp (1970:1711).

*Ochlerotatus trivittatus* of Coquillett (1906b:21).

*Grabhamia trivittatus* of Dyar (1905a:48; 1905c:187).

*Pseudohowardina trivittata* of Theobald (1907:224-227; 1910:227).

*Culex trivittatus* of Blanchard (1905:339); Theobald (1905:27).

*Aedes inconspicuus* of Dyar and Knab (1906a:199).

*Ochlerotatus inconspicuus* of Coquillett (1906b:21).

*Culex inconspicuus* of Dyar (1905b:108); Theobald (1910:387).

*Aedes (Ochlerotatus) trivittatus cuneatus* in part of Dyar (1922a:54).

*Aedes infirmatus* of Rigby (1968:239-240).

**FEMALE** (figs. 17,18). Wing: 3.75 mm. Proboscis: 2.40 mm. Forefemur: 1.70 mm. Abdomen: 3.25 mm. **Thorax:** Dorsocentral line of light scales complete, unbroken from anterior promontory to scutellum, usually expanded laterally in supraalar area; scales usually white, occasionally yellowish white to light yellow; white scales present above paratergite. **Legs:** Knee spots of white scales present posteriorly on apices of femora. **Abdomen:** Terga entirely dark scaled dorsally or with narrow basal band or median patch of white scales on terga II-VI.

**MALE** (figs. 17,18). Wing: 3.50 mm. Proboscis: 2.30 mm. Forefemur: 1.60 mm. Abdomen: 3.55 mm. **Thorax:** Longitudinal line of light scales usually broadened laterally, often to scutal margin. **Legs:** Posterior claw of midleg small, with acute subbasal tooth. **Abdomen:** Terga with basal bands of white scales.

**MALE GENITALIA** (fig. 18). **Segment IX:** Anterior middorsal emargination of tergum broad and shallow, caudal bridge connecting tergal lobes broad; tergal lobes usually broader than high, with 4-8 setae. **Sidepiece:** Length about 3.0-4.0 times median width; tergal surface with lateral setae longer than mesal setae and 3 sub-apicotergal setae; sternomesal margin with about 45-55 long setae; apical tergomesal lobe moderately developed; basal tergomesal lobe well developed, triangular with anterior and posterior sides subequal in length, about 20-25 undifferentiated setae, those on margin of setal cluster longer, with 4 longer setae projecting distad from posterior edge of lobe. **Claspette:** Stem broadly curved dorsad, narrowed slightly distally; filament subequal in length to stem, narrow and slightly angled dorsad near base, abruptly expanded near middle with sharp retrorse process and usually several



spicules basad of retrorse process, and tapered to recurved tip. **Clasper:** Spiniform length about 12-14 times its greatest width. **Phallosome:** Aedeagus conical to slightly pyriform.

**PUPA** (fig. 18). Abdomen: 2.80 mm. Trumpet: 0.55 mm. Paddle: 0.80 mm. **Cephalothorax:** Weakly pigmented, dorsum darker. Seta 10-C usually 6-9(6-10) branched. **Abdomen:** Weakly pigmented, darker anteriorly, strongly pigmented at base of segment III. Seta 3-VII usually double (1-3b). Seta 5-IV-VI subequal to or slightly longer than length of succeeding tergum; double, very rarely single. Seta 6-IV,V usually single (rarely double or triple).

**LARVA** (fig. 19). Head: 0.85 mm. Siphon: 0.80 mm. Anal Saddle: 0.35 mm. **Thorax:** Spicules of integument moderately numerous and conspicuous, length about 4-5 times basal diameter. Seta 3-P single. Seta 7-P triple (3-4b). **Abdomen:** Seta 1-IV double (2-3b); seta 1-V double (1-3b). Seta 6-I,II double (rarely single); seta 6-III-VI single (very rarely double). Seta 13-III strongly developed, single (1-2b), subequal to seta 13-IV,V. **Segment VIII:** Comb scales moderate in size, usually with moderately differentiated median spinule, usually 20-24(16-27) in number, in irregular double to triple row. **Siphon:** Index about 2.1-2.7. Pecten with teeth evenly spaced, extending slightly beyond middle of siphon. Seta 1-S inserted just distad of pecten. **Anal Segment:** Ventral brush (4-X) with 8 pairs of setal tufts.

**SYSTEMATICS.** *Aedes trivittatus* can be separated from the other species of the Scapularis Group by the following characters: in the **female** (1) the dorsocentral line of white or occasionally yellowish white scales on the scutum is broadened in the supraalar area and (2) knee spots of white scales are present on the apices of the femora; in the **male genitalia**, generally indistinguishable from *bogotanus*, *tortilis*, *condolenscens*, *euplocamus* and *patersoni*, (1) the sidepiece length is 3 to 4 times median width, (2) the claspette filament is subequal in length to the claspette stem and has a large retrorse process with several elongate spicules basad of the process, the spicules seldom extending basad of the basal 0.2 of the filament, (3) the sternomesal margin of the sidepiece has 45 to 55 long setae between the basal tergomesal lobe and the clasper, (4) the claspette stem is broadly curved dorsad and not expanded distally, (5) the apical tergomesal lobe of the sidepiece is moderately to well developed, and (6) the spiniform length is about 12 to 14 times its greatest width; in the **larva** (1) seta 1-IV,V is usually double, (2) setae 5,6-C are single, (3) seta 6-I is double and 6-II-VI is single, (4) the median spinule of the comb scales is slightly larger than the lateral spinules, and (5) the spicules of the thoracic and abdominal integument are only moderately long, length about 4 to 5 times basal diameter.

In the female, this species is inconstant in the amount of white scaling on the dorsum of the abdomen, many specimens being completely dark scaled but most having a narrow basal band or median patch of white scales on the base of terga II to VI, and the dorsocentral line of light scales on the scutum is usually white but rarely yellowish white or yellow. There is also some variability in the length of the median spinule of the larval comb scale, occasionally it being subequal in length to the subapical spinules. Specimens with these variations seem to be more or less randomly distributed in the *trivittatus* population.

*Aedes trivittatus* is one of the more common *Aedes* species in the upper midwest and northeast United States as discussed below under bionomics, and is a Nearctic representative of a primarily Neotropical group (other exceptions are *infirmatus* and *thelcter* in the southern United States, and intrusions of *tortilis* and *scapularis* into the Nearctic in northeastern Mexico and Florida). The present distribution of *trivittatus* is probably post-Pleistocene and may be northward expansion from Pleisto-



cene refugia in northern Mexico and the southwestern United States. If this is indeed the case, *trivittatus* may have been much more common in central and southern Mexico during the Pleistocene, which may account for the apparent introgressive hybridization of *trivittatus* with *angustivittatus* in southern Mexico (see discussion under *angustivittatus* above). The above mentioned variation in female scutal and abdominal scaling and larval comb scales in some *trivittatus* specimens from throughout its range may be a manifestation of the *angustivittatus* genotype resulting from this mixing of the gene pool.

**BIONOMICS.** *Aedes trivittatus* is relatively common throughout the northeastern and central United States. It occurs in a wide variety of temporary freshwater pool situations, being commonly found in grassy depressions and bottomland forest pools filled by rain or stream overflow, although it is also found around the grassy edges of permanent ponds and marshes. In the more arid western United States and Mexico it occurs primarily along stream courses in overflow pools and blocked stream beds. In temperate climates *trivittatus* overwinters in the egg stage, the adults emerging in late spring. Development is completed in a short time, usually less than 2 weeks. The most common associates of *trivittatus* are *Aedes* (*Aedm.*) *vexans* and *A. (O.) sticticus*. Females of *trivittatus* are fierce and persistent biters, usually active in shade in the late afternoon and at dusk, although they will attack at any time of day or in any light if they are disturbed from their resting place in vegetation. Abdel-Malek (1948) discusses the habitat, larval development, feeding behavior and oviposition, and Abdel-Malek (1949) presents a superficial description of the egg, 4 larval instars and pupa of *trivittatus*. A more thorough description and figures of the egg are given by Horsfall and Craig (1956:372).

The considerable extent of arbovirus activity in this species is discussed above under Medical Importance.

**DISTRIBUTION** (fig. 2). *Aedes trivittatus* is known from Nova Scotia, Ontario and Manitoba in Canada, the United States as far south as Georgia and Texas and west to Idaho, Utah and Arizona, and Mexico as far south as Oaxaca. Material examined: 860 specimens; 100 males, 415 females, 137 pupae, 208 larvae; 46 individual rearings (43 larval, 2 pupal, 1 incomplete).

**MEXICO.** **Coahuila:** El Carmen (4 km W; 62 km W of La Rosa on hwy 40), 1500 m, 9 July 1965, R. Schick and D. Schroeder (MEX 184), 1 F [UCLA]. **Distrito Federal:** Mexico City, 21 June 1926, A. Herrera, 1 F [USNM]. Xochimilco, 4-8 May 1973 (MEX 744), 1 F [UCLA]; Xochimilco, R. Balanzario, 1 F [USNM]. **Morelos:** Tepotzlan (8 km W), 1600 m, 28 June 1970, K. and D. Schroeder (MEX 507), 1 IP (10) [UCLA]; same data (MEX 511), 2 pM (103,105) [UCLA]. **Oaxaca:** Oaxaca, 30 June 1944, B. Brookman, 1 M [UCLA]. Tule, 3 June 1944, B. Brookman, 1 F [UCLA]. **Zacatecas:** Zacatecas (20 km SW on hwy 54), 2000 m, 9 June 1971, T. Zavortink and L. Nielsen (MEX 684), 2 F [UCLA].

**UNITED STATES.** **Arizona:** Duncan, Greenlee Co., 17 Sept 1953, 1 F [UTAH]. Ft. Huachuca, 31 Aug 1966, J. King, 1 M [USNM]. Ft. Huachuca, 7-9 Aug 1973, Fujii, 2 M [Ft. Baker]; same locality and collector, 24 July 1973, 1 M [Ft. Baker]; same locality and collector, 21-23 Aug 1973, 1 M [Ft. Baker]; same locality, 1 M [UCLA]. Patagonia (4 km SW), 13 Sept 1964, J. Burger (UCLA 258), 5 M, 4 F, 2 L [UCLA]; same data (UCLA 271), 12 L [UCLA]. Sabino Canyon, Santa Catalina Mts., 17 Aug 1963, J. Burger (UCLA 399), 2 F [UCLA]; same locality and collector, 18 Aug 1963 (UCLA 400), 3 F [UCLA]; same locality and collector, 21 Sept 1963 (UCLA 406-1), 1 F [UCLA]; same locality and collector, 24 Sept 1963 (UCLA 407-1), 3 F [UCLA]. Williams, 2100 m, 4,5 Aug 1956, J. Belkin and W. McDonald (UCLA 211,216), 3 F [UCLA]. **Colorado:** Aurora, 6 Sept 1944, L. Perry, 1 F [UTAH]. Denver, 26 Aug 1948, Anthony, 1 L [USNM]. Ft. Logan, 10 July 1944, L. Perry, 1 F [UTAH]. Rifle, 12 Aug 1958, F. Harmston, 2 F [UCLA]. Weld Co., 14 June 1950, G. Thompson, 1 M [UCLA]. **District of Columbia:** Aug



1928, F. Edwards, 2 M, 1 F [BM]. **Idaho:** Nampa, 27 June 1945, F. Harmston, 1 F [UTAH]. **Illinois:** Champaign, June 1972, Busey (UCLA 736), 14 lpM (20-29,40-43), 24 lpF (10-19,30-39,44-47), 25 M, 10 F, 35 p, 35 l, 55 L, E [UCLA]. Havana, 8 July 1941, Burke and Reigel, 1 F [UTAH]. Wadsworth, 10 June 1942, Ross and Sanderson, 1 F [UTAH]. **Indiana:** Spencer, 21 June 1934, 6 F [USNM]. **Iowa:** Mt. Pleasant, 1 June 1923, Yant, 5 F [USNM]. **Kansas:** Douglas Co., Aug 1956, 1 F [USNM]. Lawrence, 25 June 1951, R. Roberts, 3 F [UTAH]. **Maine:** Paris, 3 Sept 1910, W. Perham, 5 F [USNM]. **Maryland:** Baltimore, 5 Aug 1919, 2 F [UCLA]. **Massachusetts:** S. Amherst, 10 July 1903, G. Dimmock, 1 F [USNM]. Westfield, 30 July 1903, F. Knab, 1 F [USNM]. **Michigan:** St. Joseph, 25 June 1942, C. Sabrosky, 1 M, 1 F [USNM]. So. Haven, 23 July 1938, C. Sabrosky, 1 F [USNM]. **Minnesota:** Chatfield, 29 Aug 1923, 12 F [USNM]. Thief River Falls, 29 May 1922, H. Dyar, 2 F [USNM]; same locality and collector, 30-31 May 1922, 28 F [USNM]. **Missouri:** Camp Crowder, 12 Aug-13 Sept 1942, A. Gurney, 7 F, 2 L [USNM]. St. Louis, 23 June 1952, R. Roberts, 1 F [UTAH]. **Montana:** Glasgow, 12 July 1921, H. Dyar, 33 F [USNM]. Glendive, 18 June 1922, H. Dyar, 10 F [USNM]. Laurel, 16 July 1917, H. Dyar, 1 lpM (Y3), 4 lpF (Y1,Y2,Y4,Y5), 2 M, 40 F [USNM]. Miles City, 23 July-25 Aug 1915, 6 M, 17 F [UTAH]. **Nebraska:** Crete, 13 Aug 1944, 1 F [UCLA]. Hall Co., 21 Aug 1949, G. Thompson, 1 M [UCLA]. Lincoln, 19 Aug 1954, L. Quate, 3 F [UCLA]. Rulo, Richardson Co., 22 July 1944, 1 F [UCLA]. Valentine, 6 Nov 1942, 1 F [UCLA]. Walthill, Thurston Co., 29 June 1943, 3 F [UCLA]. Wellfleet, Lincoln Co., 24 June 1961, F. Harmston, 3 F [UTAH]. **New Jersey:** Chester, 10 or 14 Sept, J. Smith, 1 F (*trivittatus* holotype) [USNM]. Chester, J. Aldrich, 1 F [USNM]. Culver's Lake, 13 June 1947, S. Carpenter, 1 M [UTAH]; same locality and collector, 11 July 1947, 3 L [UTAH]. Garret Mts., Paterson, 5 Oct, 1 M (*inconspicuus* lectotype) [USNM]. New Brunswick, 30 July 1 F [BM]. [?] Gt. Piece Mdw, 6, 15 Sept, J. Aldrich, 2 F [USNM,BM]. **New Mexico:** Canjillon, Rio Arriba Co., 12 June 1967, L. Nielsen, 9 L [UTAH]. San Juan Co., 9 July 1960, L. Jensen, 1 F [UTAH]. Socorro (Escondida Rec. Area), 1400 m, 3 Sept 1966, T. Zavortink (UCLA 324), 2 F [UCLA]. **New York:** Tuxedo [Park], Aug 1928, F. Edwards, 1 F [BM]. **North Dakota:** Mandan, 15 June 1923, H. Dyar, 7 F [USNM]. **Pennsylvania:** Shippensburg, 8 Sept 1933, 5 F [USNM]. **Texas:** Denison, 22 June 1904, H. Barber, 1 M, 22 F [USNM]. **Utah:** Indian Creek St. Park, San Juan Co., 14 June 1970, L. Nielsen and S. Romney (N-9-70), 18 M, 19 F, 56 p, 36 l, 9 L [UTAH]. Canyonlands N. P., San Juan Co., 15 June 1970, L. Nielsen and S. Romney (N-10-70), 9 M, 15 F [UTAH]. **Virginia:** Rosslyn, 3 Aug 1916, A. Caudell, 1 F [USNM]. Woodstock, 5 Aug 1904, F. Pratt, 15 F [USNM]. **Wisconsin:** Darlington, 26 Aug 1933, 41 F [USNM]. Univ. Wisconsin Arboretum, Dane Co., 15 June-13 Aug 1960, P. Thompson, 3 M, 22 F [USNM]. **Wyoming:** Thermopolis, 3 Aug 1944, L. Perry, 1 F [UTAH].

#### Additional Records from the Literature

CANADA. **Manitoba:** Pinawa, 10 km NE (Trimble, 1972:1535). **Nova Scotia:** Pictou (Gibson, 1939:109). **Ontario:** London (Judd, 1954:107).

UNITED STATES. **Alabama:** Pickwick Res. (Breeland, Snow and Pickard, 1961:293). **Georgia:** Lee County (Root, 1924:452). **South Carolina:** Georgetown (Bradley, Fritz and Perry, 1944:109). **Texas:** Junction (Breland, 1951:369).

#### TORTILIS SUBGROUP

**FEMALES. Head:** Occipital dorsolateral dark scale patch conspicuous to nearly absent. Palpus 3 or 4 segmented. **Thorax:** Anterior of scutum usually with golden to tan scales to near level of posterior end of paratergite except for dark brown scales covering most of fossa; golden to tan scales often extending posteriorly along acrostichal line and surrounding prescutellar bare space and along dorsocentral line to scutellum, and occasionally extending laterally into supraalar area; a few whitish



scales above paratergite; remainder of scutal scales dark brown. Scutum rarely uniformly dark brown scaled or with anterior scales only slightly lighter in color. Acrostichal, anterior dorsocentral, and posterior fossal setae absent. Subspiracular scale patch reduced. **Legs:** Knee spots of white scales absent posteriorly on apices of femora. Tibiae and basal tarsal segments with conspicuous white streak posteriorly. Claws of hindleg with moderate to small acute submedian tooth, or claws simple. **Wing:** Scales entirely dark. **Abdomen:** Terga II-VII with narrow to broad basal white bands, usually narrower or absent on more distal segments.

**MALES. Thorax:** Scutal scale pattern generally similar to female, light scales usually white. **Legs:** Anterior claw of foreleg and midleg considerably enlarged, with blunt submedian tooth and acute basal tooth; posterior claw of foreleg moderately enlarged. **Abdomen:** Terga with narrow basal bands of white scales.

**DISCUSSION.** The *Tortilis* Subgroup is defined by the female ornamentation of a large anterior scutal scale patch of usually golden to tan scales which contrast with the dark brown scales of most of the remainder of the scutum, and the very small subspiracular scale patch, often consisting of fewer than 8 scales.

The subgroup consists of 2 species, *tortilis* and *auratus*. *Aedes tortilis* inhabits the West Indies south to St. Lucia, with a limited intrusion into southern Florida; *auratus* is known only from Kingston, Jamaica.

### 8. *Aedes (O.) tortilis* (Theobald)

Figs. 1,20,21,22

- 1903. *Culex tortilis* Theobald, 1903b:281-282. TYPE: *Lectotype* female, Kingston, Jamaica, 20 Aug 1903, M. Grabham [BM; selection of Belkin, 1968:8].
- 1906. *Culex bracteatus* Coquillett, 1906a:184. TYPE: *Holotype* female, Havana, Cuba, 1 Nov 1902, J. R. Taylor [USNM, 7753; see Stone and Knight, 1956:215]. Synonymy with *tortilis* by Dyar (1922a:55) as subspecies.
- 1906. *Aedes habanicus* Dyar and Knab, 1906a:198. TYPE: *Lectotype* fragments of a larval skin, Havana, Cuba, 28 Oct 1903, J. R. Taylor [USNM, selection of Stone and Knight, 1956:218]. Synonymy with *bracteatus* apparently by Howard, Dyar and Knab (1917:802).
- 1907. *Aedes balteatus* Dyar and Knab, 1907:9-10. TYPE: *Holotype* female, Santo Domingo (Dominican Republic), Aug 1905, A. Busck [USNM, 10142; see Stone and Knight, 1956:215]. Synonymy with *tortilis* by Dyar (1922a:55-56), as subspecies.
- 1907. *Aedes plutocraticus* Dyar and Knab, 1907:11. TYPE: *Holotype* female (no. 10), Nassau, Bahama Islands, 21 June 1903, T. H. Coffin [USNM, 10251; see Stone and Knight, 1956:224]. Synonymy with *tortilis* by Dyar (1922a:55), as subspecies.
- 1922. *Aedes tortilis virginensis* Dyar, 1922a:56. TYPE: *Holotype* female, St. Thomas, Virgin Islands, Aug 1905, A. Busck [USNM, 24898].

*Aedes (Ochlerotatus) tortilis* of Bonne and Bonne-Wepster (1925:394), Dyar (1928:169-170, in part); Edwards (1932:142, in part); Lane (1939:117, in part; 1953:653-654, in part); Pritchard, Seabrook and Mulrennan (1947:11); Carpenter and La Casse (1955:245-247, in part); Perez Viguera (1956:296-301); Stone, Knight and Starcke (1959:156, in part); Forattini (1965:369-370, in part); Montchadsky and Garcia Avila (1966:29,78); Porter (1967:38,39,40); Stone (1969:5); Belkin, Heinemann and Page (1970:165-168).

*Aedes tortilis* of Howard, Dyar and Knab (1917:806-809, in part); Dyar (1918a:77); Gerry (1932:38-39); Staebler and Buren (1946:685); Thurman, Haeger and Mulrennan (1949:171); Torre y Callejas, Alayo Delmau and Calderon Chapman (1961:67, in part); Garcia Avila and Gutsevich (1969:6).



*Culex tortilis* of Theobald (1905:26); Theobald and Grabham (1905:26); Surcouf and Gonzalez-Rincones (1911:175).

*Aedes (Ochlerotatus) tortilis tortilis* (in part) of Dyar (1922a:54-55).

*Aedes (Ochlerotatus) tortilis bracteatus*, *tortilis balteatus* and *tortilis plutocraticus* of Dyar (1922a:54-56).

*Aedes tortilis balteatus* of Root (1927:465).

*Aedes (Ochlerotatus) bracteatus*, *balteatus*, *plutocraticus* and *virginensis* of Bonne and Bonne-Wepster (1925:393-394).

*Aedes (Heteronychia) tortilis*, *bracteatus* and *plutocraticus* of Dyar (1920:105).

*Aedes bracteatus* of Pazos (1908:423); Howard, Dyar and Knab (1917:802-804); Dyar (1918a:77).

*Ochlerotatus bracteatus* of Coquillett (1906b:20).

*Aedes balteatus* of Howard, Dyar and Knab (1917:809-810); Dyar (1918a:77).

*Aedes plutocraticus* of Johnson (1908:70); Howard, Dyar and Knab (1917:804-805); Dyar (1918a:77).

*Aedes (Ochlerotatus) ? condolezens* of Root (1922:398-399).

**FEMALE** (figs. 20,21). Wing: 2.80 mm. Proboscis: 2.10 mm. Forefemur: 1.60 mm. Abdomen: 2.80 mm. **Thorax:** Anterior of scutum except for fossa usually with golden to tan scales; scutum rarely uniformly dark brown scaled or with anterior scales only slightly lighter in color.

**MALE** (figs. 20,21). Wing: 3.05 mm. Proboscis: 2.20 mm. Forefemur: 1.55 mm. Abdomen: 3.05 mm. **Thorax:** Anterior of scutum except for fossa with white to yellowish white scales, white scales often continued posteriorly to prescutellar bare space and above wing; remainder of scutum with dark scales.

**MALE GENITALIA** (fig. 21). **Segment IX:** Anterior middorsal emargination of tergum broad and shallow, caudal bridge connecting tergal lobes broad; tergal lobes about as broad as high, with 1-8 setae. **Sidepiece:** Length about 3.5-4.0 times median width; tergal surface with setae evenly distributed, becoming longer near level of base of apical tergomesal lobe, and 2-4 subapicotergal setae; sternomesal margin with about 40-50 long setae; apical tergomesal lobe well developed; basal tergomesal lobe well developed, triangular with anterior side longer and setae arising from posterior side, with about 10-20 setae. **Claspette:** Stem uniformly narrow and broadly curved dorsad; filament slightly longer than stem, narrow at base and expanded near middle with large retrorse process and several elongate spicules basad of retrorse process, and tapered gradually to recurved tip. **Clasper:** Spiniform length about 10-14 times its greatest width. **Phallosome:** Aedeagus ovate to slightly pyriform.

**PUPA** (fig. 21). Abdomen: 3.05 mm. Trumpet: 0.40 mm. Paddle: 0.70 mm. **Cephalothorax:** Weakly pigmented, slightly darker dorsally. Seta 10-C usually 6-8 (4-10) branched. **Abdomen:** Weakly pigmented, slightly darker anteriorly and near base of most segments. Seta 5-IV,V shorter than or subequal in length to length of succeeding tergum, usually double (1-4b); seta 5-VI about half length of succeeding tergum, double (1-2b); seta 5-VII about 1/3 length of seta 3-VII and usually 4-6 branched. Seta 6-VI double or triple (1-4b).

**LARVA** (fig. 22). Head: 0.85 mm. Siphon: 0.75 mm. Anal Saddle: 0.30 mm. **Thorax:** Spicules of integument sparse, short, length about 1-2 times basal diameter. Seta 3-P single. Seta 7-P double (1-3b). **Abdomen:** Seta 1-IV,V single (1-3b). Seta 6-I,II usually double (1-3b); seta 6-III-VI single. Seta 13-III weakly developed, multiple, subequal to seta 13-II; seta 13-IV,V strongly developed, single. **Segment VIII:** Comb scales moderate in size, with slightly differentiated median spinule,



about 20 (16-28) in number, in irregular double to triple row. **Siphon:** Index about 2.1 to 2.8. Pecten with teeth evenly spaced, extending to middle of siphon. Seta 1-S inserted slightly distad of pecten. **Anal Segment:** Ventral brush (4-X) with 8 pairs (rarely 9 pairs) of setal tufts, the most proximal tuft occasionally arising from within or on margin of saddle.

**SYSTEMATICS.** *Aedes tortilis* can be separated from the other species of the Scapularis Group by the following characters: in the **female**, indistinguishable from *auratus*, the scutum has a large patch of golden to tan scales anteriorly; in the **male genitalia**, generally indistinguishable from *bogotanus*, *trivittatus*, *condolenscens*, *euplocamus* and *patersoni*, (1) the sidepiece length is about 3.5 to 4 times median width, (2) the claspette filament is slightly longer than the stem and has a large retrorse process with several elongate spicules basad of the process, the spicules seldom extending basad of the basal 0.2 of the filament. (3) the sternomesal margin of the sidepiece has 40 to 50 long setae between the basal tergomesal lobe and the clasper, (4) the claspette stem is broadly curved dorsad and not expanded distally, (5) the apical tergomesal lobe of the sidepiece is well developed, and (6) the spini-form length is about 12 to 14 times its greatest width; in the **larva** (1) seta 13-III is weakly developed, multiple and subequal to 13-II, (2) seta 6-I,II is usually double, and (3) the spicules of the thoracic and abdominal integument are sparse and short, length only 1 to 2 times basal diameter.

Howard, Dyar and Knab (1917:802-810) considered as geographically isolated distinct species *plutocraticus* from the Bahama Islands, *bracteatus* from Cuba, *tortilis* from Jamaica and *balteatus* from Hispaniola, and Dyar (1922a:54-56) treated the above populations, including *virginensis* from the Virgin Islands and Lesser Antilles as a complex of subspecies, although in his later treatment (1928:169-170) he considered these to be a single species. I have seen usually large numbers of specimens of all stages of *tortilis* from most of the insular populations and I am in agreement with Dyar, considering it to be a single species with no more than moderate variation. However, I have seen only females from Florida, the Bahamas, and Cuba, and these specimens exhibit more variation in the color of the anterior scutal scales than do specimens from other Antillean islands, the scutal scales occasionally being concolorous dark brown. Lack of other stages from these areas precludes determination of possible variation coinciding with that of the female.

*Aedes tortilis* also shows some variability in the number of white scales above the paratergite and the number of subspiracular scales in the female, and, in the larva, very slight differences in the density of the thoracic and abdominal spicules; however, these differences appear to be random and are not correlated with the different insular populations. The variation in the anterior scutal scale coloration, as mentioned above, may be clinal, since it occurs more frequently in the northern populations.

**BIONOMICS.** *Aedes tortilis* typically breeds in temporary or semipermanent freshwater ground pools formed by rain or stream overflow, although it is often found near the margin of permanent lakes and marshes and in brackish water ground pools in mangrove swamps. It has been taken from crabholes in Puerto Rico in association with *Culex (C.) habilitator* and *Deinocerites magnus*, from pools in blocked and intermittent streams, from animal tracks and potholes in marshes and from rockholes. Females bite man regularly and are commonly taken in animal-baited traps and light traps.

**DISTRIBUTION** (fig. 1). *Aedes tortilis* is known from southern Florida, the Bahama Islands, Cuba, Grand Cayman Island, the Greater Antilles and the Lesser Antil-



les as far south as St. Lucia. Records of *tortilis* from Mexico and Guatemala by Martini (1935:54) are undoubtedly in error. Material examined: 1629 specimens; 183 males, 675 females, 324 pupae, 447 larvae; 161 individual rearings (72 larval, 66 pupal, 23 incomplete).

**ANTIGUA. St. George Parish:** Emerson's Pond (E of Sea View Farm), 60 m, 15 Sept 1965, T. Aitken, R. Martinez and A. Guerra (ANT 33), 8 F [UCLA]. Fitches Creek, nr. Piggotts, 7 m, 23 Sept 1965, R. Martinez and A. Guerra (ANT 87), 1 F [UCLA]. **St. John Parish:** Bendals, nr. St. John's, 30 m, 22 Sept 1965, R. Martinez and A. Guerra (ANT 84), 1 pM (100) [UCLA]. Stuart's Pasture, nr. Potters, 22 m, 16 Sept 1965, R. Martinez and A. Guerra (ANT 54), 9 F [UCLA]; same data (ANT 56), 5 F [UCLA]; same locality and collectors, 20 Sept 1965 (ANT 77), 14 F [UCLA]; same data (ANT 78), 7 F [UCLA]; same locality and collectors, 21 Sept 1965 (ANT 81), 22 F [UCLA]. **St. Mary Parish:** Wallings Reservoir, nr. Sweets, 150 m, 15 Sept 1965, T. Aitken, R. Martinez and A. Guerra (ANT 46), 1 lpM (30), 2 lpF (31,36), 1 pF (101), 1 lp (33), 11 M, 19 F, 30 p, 3 P, 2 l, 7 L [UCLA]; same data (ANT 47), 11 M, 9 F [UCLA]; same locality and collectors, 27 Sept 1965 (ANT 114), 12 L [UCLA]; same data (ANT 115), 3 L [UCLA]. **St. Paul Parish:** Bethesda, 3 m, 13 Sept 1965, R. Martinez and A. Guerra (ANT 15), 1 pM (101), 1 pF (100) [UCLA]; same data (ANT 16), 4 L [UCLA]. Brooks Estate, nr. Liberta, 23 Sept 1965, R. Martinez and A. Guerra (ANT 92), 3 L [UCLA]. Matthews, nr. All Saints, 60 m, 15 Sept 1965, T. Aitken, R. Martinez and A. Guerra (ANT 44), 2 F [UCLA]; same locality, 29 Sept 1965, R. Martinez and A. Guerra (ANT 120), 2 F [UCLA]; same data (ANT 122), 1 F [UCLA]. All Saints, 60 m, 15 Sept 1965, T. Aitken, R. Martinez and A. Guerra (ANT 38), 1 F [UCLA].

**BAHAMA ISLANDS.** Andros Island, 21 June 1903, T. Coffin, 2 F [USNM]; same locality and collector, 26 June 1903, 2 F [USNM]. Eleuthera Island, Powell Point, 1903, T. Coffin, 3 F [USNM]. Eleuthera Island, Tarpon [Tarpum] Bay, 1903, T. Coffin, 4 F [USNM]. New Providence Island, Nassau, 21 June 1903, T. Coffin, 1 F (*plutocraticus* holotype) [USNM]; same locality and collector, 23 June 1903, 36 F [USNM]. New Providence Island, Winton, Yamacraw Beach, 5 Aug 1972, T. Rogers (BAH 48-1), 1 F, E [UCLA]. San Salvador Island, 1903, T. Coffin, 6 F [USNM].

**CAICOS ISLANDS.** [?] Ft. George Cay, 24 July 1930, Bishopp, 1 F [USNM].

**CUBA. Havana:** Havana, 14 May 1902, J. Taylor, 1 F [USNM]; same locality and collector, 1 Nov 1902, 1 F [USNM]; same data, 1 F (*bracteatus* holotype) [USNM]; same locality and collector, 28 Oct 1903, 1 l (*habanicus* lectotype) [USNM]; same locality and collector, 10 Nov 1903, 1 F [USNM]. Havana, 1905, P. Serre, 1 M [USNM]. San Antonio de los Banos, J. Pazos, 8 F [USNM]. **Las Villas:** Rosario Cay [Cayo del Rosario], 19 Sept 1930, Bishopp, 1 F [USNM]. **Oriente:** Cayamas, E. Schwarz, 14 F [USNM]. Guantanamo Naval Base, 27 Oct 1953, K. Knight (378), 1 F [UCLA]; same locality and collector, 27 Oct 1953 (450), 2 F [UCLA]; same data (452) 1 F [UCLA]. **Pinar del Rio:** Mariel, J. Pazos, 2 F [USNM]. **Locality unspecified:** 1914, J. Pazos, 23 F [USNM].

**DOMINICA.** Roseau, 15 km N, Clarke Hall Estate, 7 June 1966, G. Steyskal, 1 F [USNM]. Locality unspecified, 1927, A. Carment, 5 M, 3 F [BM].

**DOMINICAN REPUBLIC. Dajabon:** Dajabon (2 km N), 40 m, 11 July 1971, T. Rogers (RDO 114), 1 lpF (15), 1 lP (12) [UCLA]. **Distrito Nacional:** Santo Domingo, Aug 1905, A. Busck, 4 F [USNM]; same data, 1 F (*balteatus* holotype) [USNM]. Santo Domingo, Finca Engombe, 20 m, 20 Aug 1971, T. Rogers (RDO 252), 1 lpM (74), 2 lpF (52,53) [UCLA]; same locality and collector, 28 Aug 1971 (RDO 266), 2 F [UCLA]; same data (RDO 267), 1 M, 3 F, 3 L [UCLA]; same data (RDO 268), 1 lpM (49), 1 lpF (40), 1 L [UCLA]; same locality and collector, 29 Aug 1971 (RDO 270), 1 M [UCLA]; same data (RDO 272), 1 pF (111), 5 M, 8 F, 1 L [UCLA]; same data (RDO 273), 5 F [UCLA]; same locality and collector, 30 Aug 1971 (RDO 276), 1 F, E [UCLA]; same locality and collector, 31 Aug 1971 (RDO 280), 4 F [UCLA]; same locality and collector, 6 Sept 1971 (RDO 288), 1 M, 1 F [UCLA]; same locality and collector, 13 Sept 1971 (RDO 296), 1 lp (26), 1 L [UCLA]. **Duarte:** San Francisco de Macoris, 75 m, 17 July 1968, D. Watson (RDO 7), 2 F [UCLA]. **La Vega:** La Vega, 75 m, 25 July 1968, D. Watson (RDO 24), 3 F [UCLA]. **Peravia:** Los Anones, San Jose de Ocoa, 960 m, 23 July 1968, D. Watson (RDO 22), 1 F [UCLA]. **Samana:** [Santa Barbara de] Samana, 2 m, 27 June 1971, J. Belkin and T.



Rogers (RDO 49), 1 F [UCLA]. Sanchez, 4 Apr 1949, J. Brennan, 13 F [USNM]. Sanchez Ramirez: Cotui, 55 m, 20 July 1968, D. Watson (RDO 18), 1 F [UCLA]. Valverde: Mao, 400 m, 14 Aug 1971, T. Rogers and J. Gomes (RDO 223), 1 F [UCLA].

FRENCH WEST INDIES. GUADELOUPE. Basse-Terre: Baie Mahault, 21 Oct 1973, G. Cornely (FWI 955), 2 L [UCLA]; same data (FWI 957), 10 L [UCLA]. Goyave, 17 Feb 1974, G. Cornely (FWI 1011), 1 P, 3 L [UCLA]. Petit Bourg, 5 Mar 1972, G. Cornely (FWI 889), 1 pM (14), 1 pF (16) [UCLA]; same data (FWI 890), 8 L [UCLA]. Grande-Terre: Abymes, 20 Oct 1973, G. Cornely (FWI 951), 9 L [UCLA]; same data (FWI 952), 21 L [UCLA]; same locality and collector, 27 Jan 1974 (FWI 996), 56 L [UCLA]. Gosier, 50 m, 3 Mar 1974, G. Cornely (FWI 1016), 27 L [UCLA]; same data (FWI 1017), 27 L [UCLA]. St. Francis, 3 Feb 1974, G. Cornely (FWI 1000), 8 L [UCLA]; same data (FWI 1002), 12 P, 1 L [UCLA].

FRENCH WEST INDIES. MARIE GALANTE. St. Louis, 3 m, 15 Oct 1965, P. Fauran (FWI 265), 5 lpM (11-14,17), 5 lpF (10,15,16,18,19), 1 lp, 6 P, 6 l, 20 L [UCLA]; same data (FWI 268), 1 lpM (10), 1 lpF (11) [UCLA].

GRAND CAYMAN ISLAND. 16 Aug 1964, E. Gerberg (CAY 7), 1 F [UCLA]; 13 Aug 1966, M. Giglioli (CAY 11), 3 F [UCLA]; July 1966, M. Giglioli (CAY 11A), 20 F [UCLA]; 13 Aug 1966, M. Giglioli (CAY 12), 1 F [UCLA]; 9 Sept 1968, J. Belkin and E. Gerberg (CAY 110,111), 15 F [UCLA].

HAITI. Nord: Bayeaux, 12 Sept [1931] (HAR 27), 3 F [UCLA]; same locality, 13 Sept (HAR 29), 1 F [UCLA]. Roche Platte, 6 Oct 1925, 1 F [UCLA]. Nord-Ouest: Port de Paix (La Pointe "House of Hope"), 7 Oct 1970, J. Porter (HAT 114), 1 F [UCLA]; same locality and collector, 8 Oct 1970 (HAT 121), 21 F [UCLA]. Ouest: Godet, 300 m, 6 July 1968, D. Watson (HAT 12), 1 F [UCLA]. Port-au-Prince, 14 Sept 1930 (HAR 20), 1 F [UCLA]. Port-au-Prince 10 Oct 1970, M. Solis (HAT 133), 1 F [UCLA]. Sud: Trou Zombi, 25 May 1932, S. Cook, 2 F [USNM]. Locality unspecified: 23 May 1931 (HAC 6), 3 F [UCLA]; 27 May 1931 (HAC 7), 11 F [UCLA]; 4 June 1931 (HAC 8), 1 M, 4 F [UCLA]; 2 July 1931, S. Cook (HAC 9), 12 F [UCLA]; 9 July 1931 (HAC 10), 10 F [UCLA].

JAMAICA. Clarendon: Milk River Bath, 0 m, 15 Aug 1967, W. Page (JA 730), 2 L [UCLA]. Parnassus, 10 m, 28 July 1967, W. Page (JA 863), 2 pF (38,112), 1 l, 1 L [UCLA]. Kingston and St. Andrew: Hill Gardens, July 1924, G. Strathaim, 1 F [USNM]. Kingston, 20 Aug 1903, M. Grabham, 5 F [BM]; same data, 1 F (*tortilis* lectotype) [BM]. Liguana, 3 June 1931, Kisliak, 1 F [USNM]. St. Andrew: Ferry, 6 Sept 1966, D. Watson (JA 610), 5 F [UCLA]. Ferry, 0 m, 18 Sept 1967, W. Page (JA 796), 2 lpM (19,21), 8 lpF (11,13,15,16,18,23,24,26), 9 pM (90,92,100,103,104,106,109,110,114), 4 pF (93,94,105,113), 1 lp (10), 3 lP (12,17,22), 1 M, 1 P, 33 L [UCLA]; same locality and collector, 17 Sept 1967 (JA 799), 1 F, 2 p, 1 l [UCLA]. Ferry, 15 m, 9 Aug 1967, J. Belkin and W. Page (JA 896), 1 pM (114), 1 pF (100), 19 M, 16 F, 4 L [UCLA]. St. Ann: Delight, 200 m, 25 Aug 1967, J. Belkin and W. Page (JA 757), 1 lpF (113) [UCLA]. St. Catherine: Bog Walk, 90 m, 4 Aug 1968, R. Hochman (JA 913), 4 F [UCLA]; same locality and collector, 5 Aug 1968 (JA 914), 2 F [UCLA]. St. Elizabeth: Luana, 0 m, 10 Sept 1965, W. Page (JA 357), 1 F [UCLA]. St. Thomas: Amity Hall, 11 Dec 1962, T. Aitken (JA 104), 1 F [UCLA]. Cheswick, 22 Oct 1964 (JA 161), 1 lpF (15), 1 P, 1 L [UCLA]. Golden Grove, 1 Feb 1965 (JA 197), 2 L [UCLA]. Holland Bay, 0 m, 11 Aug 1964, H. Tucker and G. Hamilton (JA 97), 3 lpM (11,12,15), 1 lM (13), 1 pM (100), 2 lp (10,16) [UCLA]. Holland Bay; 5 Oct 1964 (JA 143), 1 pM (5) [UCLA]. Holland Bay, 23 Oct 1964 (JA 159), 1 L [UCLA]. New Pera, 5 Dec 1962, T. Aitken (JA 19), 1 F [UCLA]. Westmoreland: Crab Pond Bay, 14 Sept 1967 (JA 790), 3 F, 1 L [UCLA].

MONTSERRAT. St. Anthony Parish: Plymouth, Elberton Estate, 60 m, 3 Oct 1965, T. Aitken, R. Martinez and A. Guerra (MNT 1), 1 lpM (10), 1 M, 1 p [UCLA]; same data (MNT 3), 1 lpM (11), 4 lpF (21-24), 1 pF (102), 1 lp (10), 2 lP (25,26), 1 F [UCLA]; same data (MNT 4), 2 lpM (10,11), 1 pM (100), 1 lP [UCLA]; same data (MNT 5), 2 lpM (10,14), 5 lpF (13,15-18), 5 M, 6 F, 11 p, 11 l, 1 L [UCLA]; same data (MNT 7), 1 F [UCLA]; same locality, 13 Oct 1966, R. Martinez and A. Guerra (MNT 78), 2 F [UCLA]. Plymouth, Richmond Estate, 60 m, 15 Oct 1966, R. Martinez and A. Guerra (MNT 80), 1 F [UCLA]. St. Peter Parish: Gerald's Village, 150 m, 17 Oct 1966, R. Martinez and A. Guerra (MNT 109), 2 lpF (10,12), 10 M, 6 F, 16 p, 7 l, 6 L



[UCLA]. St. John's Village, 230 m, 17 Oct 1966, R. Martinez and A. Guerra (MNT 101), 1 IP (10) [UCLA]; same data (MNT 104), 1 lpF (10) [UCLA]; same data (MNT 105), 1 IP (10) [UCLA]. Sweeney's Village, 75 m, 17 Oct 1966, R. Martinez and A. Guerra (MNT 112), 2 M, 1 F, 4 p, 3 l [UCLA]; same data (MNT 113), 1 lpF (11), 7 M, 13 F, 20 p, 12 l, 3 L [UCLA].

PUERTO RICO. **Dorado:** Levittown, 0 m, 2 Sept 1970, J. Belkin and M. Nelson (PR 160), 1 pF (101) [UCLA]. Playa Dorado-Sardinera, 0 m, 2 Sept 1970, J. Belkin and M. Nelson (PR 151), 1 pM (103), 5 pF (100-102,104,105) [UCLA]; same data (PR 155), 3 lpF (10,12,13), 2 pM (101,106), 9 pF (100,102-105,107-110), 5 M, 1 F, 4 P, 1 l, 1 L [UCLA]; same data (PR 156), 2 lpM (10,13), 1 IP (12), 1 M, 1 p, 2 L [UCLA]. **Gurabo:** Gurabo, June 1943, H. Pratt, 5 L [UCLA]; same locality and collector, 18 Oct 1943, 5 L [UCLA]. **Mayaguez:** Mayaguez, 23 Aug 1935, G. Tulloch, 1 F [UCLA]; same locality and collector, 4 Oct-4 Nov 1935, 43 F [USNM]; same locality, 20 m, 25 Aug 1970, J. Belkin (PR 116), 1 M, 1 p [UCLA]. **San Juan:** Catano, 5 May 1943, H. Pratt, 1 F [USNM]. Isla Verde, July-Aug 1956, 1 M [UCLA]. San Juan, 0 m, 1 Sept 1970, J. Belkin and M. Nelson (PR 149), 2 lpM (10,13), 6 lpF (11,12,14-17), 9 pM (100,102,103,107-112), 4 pF (104-106,113), 26 M, 27 F, 58 p, 1 l [UCLA]; same locality, May 1914, through C. Ludlow, 1 F [USNM]. **Vega Baja:** Camp Tortuguera, 21 Aug 1942, T. Aitken and H. Pratt (PRA 44), 3 L [UCLA].

ST. LUCIA. Anse La Raye, 12 m, 22 July 1964, R. Martinez and A. Guerra (LU 74), 1 lpM (10) [UCLA]. Choc Swamp, 0 m, 17 July 1964, R. Martinez and A. Guerra (LU 50), 4 F [UCLA]; same locality and collectors, 19 July 1964 (LU 54), 2 F [UCLA]. Grande Anse, 20 July 1964, R. Martinez and A. Guerra (LU 66), 1 IP (11), 15 L [UCLA]. Mahout, 210 m, 28 July 1964, A. Guerra (LU 106), 2 F [UCLA]. Reduit Swamp, 18 July 1964, A. Guerra (LU 53), 3 F [UCLA]; same locality and collector, 19 July 1964 (LU 55), 1 F [UCLA]; same data (LU 56), 3 F [UCLA]. Sapphire Estate, 15 m, 6 Aug 1964, R. Martinez and A. Guerra (LU 162), 5 F [UCLA]. Sapphire Swamp, 45 m, 24 July 1964, R. Martinez and A. Guerra (LU 90), 1 M [UCLA]; same data (LU 92), 1 lpF (20) [UCLA]; same data (LU 93), 3 M, 11 F [UCLA]; same locality and collectors, 29 July 1964 (LU 122), 1 pF (101) [UCLA]. Vieux Fort, 3 m, 24 July 1964, R. Martinez and A. Guerra (LU 97), 1 F [UCLA]. Volet Swamp, 5 m, 28 July 1964, A. Guerra (LU 107), 9 F [UCLA]; same data (LU 108), 9 F [UCLA]; same locality and collector, 29 July 1964 (LU 117), 12 F [UCLA].

UNITED STATES. **Florida:** Key West, 28 Aug 1945, C. Spencer, 1 F [USNM]. [?] Vero Beach, 14 Mar 1962, Ent. Res. Cent., 1 F [USNM].

VIRGIN ISLANDS. **St. Croix:** Christiansted, Dec 1936, H. Beatty, 4 M, 2 F [USNM]. **St. Thomas:** Nadir, 0 m, 30 Nov 1965, D. Bonnet (VI 2), 1 lpF (10), 1 lF (11) [UCLA]. Nazareth, 0 m, 30 Nov 1965, D. Bonnet (VI 5), 4 pM (101,103,104,106), 3 pF (100,102,105) [UCLA]. Locality unspecified, Aug 1905, A. Busck, 1 F (*tortilis virginensis* holotype) [USNM].

#### Additional Records from the Literature

UNITED STATES. **Florida:** Fisher Is., Dade Co.; Belle Glade and Jupiter, Palm Beach Co. (Branch, Logan et al., 1959:159). Clewiston, Hendry Co. (Pritchard, Seabrook and Mulrennan, 1947:11).

### 9. *Aedes (O.) auratus* Grabham

Figs. 1,23,24

1906. *Aedes auratus* Grabham, 1906:313-315. TYPE: *Lectotype* male with genitalia slide (680827-15), Kingston, Jamaica, 10 Apr 1906, M. Grabham [USNM; selection of Belkin, Heinemann and Page, 1970:168]. Synonymy with *tortilis* apparently by Howard, Dyar and Knab (1917:806); resurrected from synonymy with *tortilis* by Belkin, Heinemann and Page (1970:168).

*Aedes (Ochlerotatus) auratus* of Belkin, Heinemann and Page (1970:168-169).

*Aedes auratus* of Dyar and Knab (1906b:163); Theobald (1910:598-599).



*Aedes (Ochlerotatus) tortilis* in part of Dyar (1928:169-170); Edwards (1932:143); Lane (1939: 117; 1953:653-654); Carpenter and La Casse (1955:245-247); Stone, Knight and Starcke (1959:156); Forattini (1965:369).

*Aedes (Ochlerotatus) tortilis tortilis* in part of Dyar (1922a:54-55).

*Aedes tortilis* in part of Howard, Dyar and Knab (1917:806-809); Torre y Callejas, Alayo Delmau and Calderon Chapman (1961:67).

**FEMALE. Thorax:** Anterior of scutum except for fossa with golden to tan scales.

**MALE.** Wing: 3.05 mm. Proboscis: 1.95 mm. Forefemur: 1.55 mm. Apparently indistinguishable from *tortilis*.

**MALE GENITALIA** (fig. 24). **Segment IX:** Anterior middorsal emargination of tergum broad and shallow, caudal bridge connecting tergal lobes broad; tergal lobes about as broad as high, with 3-6 setae. **Sidepiece:** Length about 4 times median width; tergal surface with short setae mesad, longer setae laterad, subapicotergal setae in row of 5 or 6, separated from more proximal setae of sidepiece by distinct bare space, and 2 or 3 large setae near base laterally; sternomesal margin with about 40 long setae; apical tergomesal lobe very well developed; basal tergomesal lobe well developed, large, broadly conical, with about 25-30 setae. **Claspette:** Stem uniformly narrow and broadly curved dorsad; filament slightly longer than stem, narrow at base, expanded near middle with large retrorse process and several elongate spicules basad of retrorse process, and tapered gradually to recurved tip. **Clasper:** Spiniform length about 10 times its greatest width. **Phallosome:** Aedeagus ovate.

**PUPA.** Unknown.

**LARVA** (fig. 23). Head: 0.75 mm. Siphon: 0.75 mm. Anal Saddle: 0.35 mm. **Thorax:** Spicules of integument sparse, short, length about 1-2 times basal diameter. Seta 3-P single. Seta 7-P double (2-3b). **Abdomen:** Seta 6-I-VI single. Seta 13-III weakly developed, multiple, subequal to seta 13-II. **Segment VIII:** Comb scales moderate in size, with slightly differentiated median spinule, about 20 (17-27) in number, in irregular double or triple row. **Siphon:** Index about 2.35-2.50. Pecten with teeth evenly spaced, extending slightly beyond middle of siphon. Seta 1-S inserted at level of most distal pecten tooth. **Anal Segment:** Ventral brush (4-X) with 8 pairs (occasionally 7 pairs) of setal tufts.

**SYSTEMATICS.** *Aedes auratus* can be separated from the other species of the Scapularis Group by the following characters: in the **female**, indistinguishable from *tortilis*, the scutum has a large patch of golden to tan scales anteriorly; in the **male genitalia** (1) the tergal surface of the sidepiece has a distinct bare space between the subapicotergal setae and the more proximal, short tergal setae, the subapicotergal setae being in a conspicuous oblique row of 5 or 6 and (2) the setae of the basal tergomesal lobe number 25 to 30; in the **larva** (1) seta 6-I,II is single, (2) seta 13-III is weakly developed and subequal to 13-II, (3) the ventral brush has 8 pairs of setal tufts, and (4) the spicules of the thoracic and abdominal integument are sparse and short, length only 1 to 2 times basal diameter.

The specimens from Grabham's original collection of *auratus* constitute all the known material of this species. The only female, in very poor condition, is impossible to distinguish from *tortilis*; however, the male genitalia and larva are very well marked as pointed out above. I am in agreement with Belkin, Heinemann and Page (1970:167-168) in their recognition of *auratus* as a full species and their observation that it is probably a relict population of an early derivative of the *tortilis* stock.

**BIONOMICS.** Larvae of *auratus* were collected by Grabham from temporary pools formed by seasonal rains in the vicinity of Kingston. No specimens of *auratus*



have been taken since the original collection was made in 1906.

**DISTRIBUTION** (fig. 1). *Aedes auratus* is known only from the type locality, Kingston, Jamaica. Material examined: 9 specimens; 3 males, 1 female, 5 larvae.

**JAMAICA.** Kingston and St. Andrew: Kingston, 10 Apr 1906, M. Grabham, 2 M, 1 F, 5 L [UCLA, USNM]; same data, 1 M (*auratus* lectotype) [USNM].

### INFIRMATUS SUBGROUP

**FEMALES.** **Head:** Occipital dorsolateral dark scale patch conspicuous to nearly absent. Palpus 3 or 4 segmented. **Thorax:** Scutum with broad anterior stripe of entirely silvery white scales or silvery white scales divided by narrow acrostichal line of tan scales; sides of stripe more or less parallel and about midway between dorso-central line and scutal margin; stripe terminating at about level of posterior end of paratergite, but often with narrow posterior extensions along dorsocentral line to scutellum and along midline meeting and encircling prescutellar bare space. Remainder of scutum with dark brown scales. Acrostichal, anterior dorsocentral, and posterior fossal setae absent. **Legs:** Knee spots of white scales present posteriorly on apices of femora. Tibiae and basal tarsal segments with conspicuous white streak posteriorly. Hindtibia and hindtarsus dark scaled anteriorly. Claws of hindleg simple or with submedian tooth. **Wing:** Scales entirely dark. **Abdomen:** Terga II-VII with large basolateral white patches; entirely dark scaled dorsally or with basal white bands or basomedian white patches.

**MALES.** **Thorax:** Anterior scutal scale patch of light scales generally similar to female. **Legs:** Anterior claw of foreleg and midleg considerably enlarged, with blunt submedian tooth and acute basal tooth, posterior claw of foreleg with acute basal tooth; posterior claw of midleg small, with acute subbasal tooth. **Abdomen:** Terga with or without basal bands of white scales.

**DISCUSSION.** The Infirmitus Subgroup is defined by the female scutal scale pattern, a broad anterior stripe of silvery white scales, rarely divided by a narrow acrostichal line of tan scales, and by the anterior surface of the hindtibia being without light scales.

The subgroup is composed of 5 species, *condolescens*, *euplocamus*, *patersoni*, *raymondi* and *infirmitus*, allopatric with one exception, and distributed in the southeastern United States, Cuba, the Bahama Islands, Central America, northern South America, southern Bolivia and northern Argentina (see fig. 3), a distribution pattern generally comparable to that of the Trivittatus Subgroup.

The distribution of the Infirmitus Subgroup suggests an origin in the Central American-Greater Antillean region, prior to or concomitant with a probable land bridge or archipelago connecting these areas.

#### 10. *Aedes (O.) condolescens* Dyar and Knab

Figs. 3,24

1907. *Aedes condolescens* Dyar and Knab, 1907:11. TYPE: *Holotype* female (10), Nassau, Bahama Islands, 24 June 1903, T. H. Coffin [USNM, 10248, see Stone and Knight, 1956: 216].

*Aedes (Ochlerotatus) condolescens* of Dyar (1928:165-166); Edwards (1932:142); Martini (1935: 54-55, in part); Lane (1939:107-108; 1953:656); Perez Vigueras (1956:278-285); Stone,



Knight and Starcke (1959:143); Forattini (1965:357-358); Montshadsky and Garcia Avila (1966:29); Porter (1967:37,39,40); Belkin, Heinemann and Page (1970:151,164).

*Aedes (Heteronychia) condolescens* of Dyar (1920:105).

*Aedes condolescens* of Johnson (1908:71); Pazos (1908:422); Howard, Dyar and Knab (1917:789-791); Dyar (1918a:77; 1924a:119); Torre y Callejas, Alayo Delmau and Calderon Chapman (1961:68).

*Aedes (Ochlerotatus) scapularis condolescens* of Dyar (1922a:59-60); Bonne and Bonne-Wepster (1925:388-390).

**FEMALE** (fig. 24). Wing: 3.00 mm. Proboscis: 1.80 mm. Forefemur: 1.40 mm. Abdomen: 2.30 mm. **Head:** Palpus 3 segmented. **Thorax:** Broad anterior scutal stripe entirely silvery white. **Legs:** Knee spots of white scales absent posteriorly on apices of femora. Claws of hindleg without submedian tooth. **Abdomen:** Terga II-VI with broad basal bands of white scales.

**MALE** (fig. 24). Wing: 3.15 mm. Proboscis: 2.20 mm. Forefemur: 1.16 mm. Abdomen: 3.05 mm. **Abdomen:** Terga with conspicuous basal bands of white scales.

**MALE GENITALIA** (fig. 24). **Segment IX:** Anterior middorsal emargination of tergum broad and shallow, caudal bridge connecting tergal lobes broad; tergal lobes about as broad as high, with 5-7 setae. **Sidepiece:** Length about 3.5 times median width; tergal surface with setae uniformly relatively long and 2-3 subapicotergal setae; sternomesal margin with 40-50 long setae; apical tergomesal lobe well developed; basal tergomesal lobe well developed, triangular, with 15-20 undifferentiated setae, distal setae longer than more proximal ones. **Claspette:** Stem uniformly narrow and broadly curved dorsad; filament subequal in length to stem, narrow at base, abruptly expanded near middle with large retrorse process and several elongate spicules basad of retrorse process, and tapered to recurved tip. **Clasper:** Spiniform length about 12 times its greatest width. **Phallosome:** Aedeagus ovate.

**PUPA, LARVA.** Unknown.

**SYSTEMATICS.** I have seen *condolescens* only in the adult and it can be separated from the other species of the Scapularis Group by the following characters: in the **female** (1) the scutum has a broad anterior stripe of silvery white scales, (2) there are no knee spots of white scales on the apices of the femora, and (3) broad basal bands of white scales are present on abdominal terga II-VI; in the **male genitalia**, generally indistinguishable from *bogotanus*, *trivittatus*, *tortilis*, *euplocamus* and *patersoni*, (1) the sidepiece length is about 3.5 times median width, (2) the claspette filament is subequal in length to the stem and has a large retrorse process with several elongate spicules basad of the process, the spicules not extending basad of the basal 0.2 of the filament, (3) the sternomesal margin of the sidepiece has 40 to 50 long setae between the basal tergomesal lobe and the clasper, (4) the claspette stem is broadly curved dorsad and not expanded distally, (5) the apical tergomesal lobe of the sidepiece is well developed, and (6) the spiniform length is about 12 times its greatest width.

This species has been reported from Puerto Rico, the Lesser Antilles, Mexico, Guatemala, Colombia, Peru, Paraguay and Argentina. Since it is actually known only from the Bahama Islands, Cuba and Grand Cayman, the erroneous distributions undoubtedly are either taxonomic misinterpretations or misidentifications of other Scapularis Group species with similar adult ornamentation, *tortilis*, *euplocamus*, *patersoni* or *scapularis*.

*Aedes condolescens* appears to be more closely allied to the Central and South



American members of the subgroup, *euplocamus* and *patersoni*, than to the geographically adjacent *infirmatus*, which occurs in the southeastern United States, commonly in southern Florida.

**BIONOMICS.** Little is known of the bionomics of *condolescens*. Adults have been taken biting man in deep to partial shade at 1630-1700 hours on Grand Cayman Island.

**DISTRIBUTION** (fig. 3). *Aedes condolescens* is known from the Bahama Islands, Cuba and the Cayman Islands. Material examined: 39 specimens; 2 males, 37 females.

**BAHAMAS.** Andros Island, 1903, T. Coffin, 4 F [USNM]. Eleuthera Island, Tarpon [Tarpon] Bay, 1903, T. Coffin, 1 F [USNM]. Long Island, 1903, T. Coffin, 1 F [USNM]. New Providence Island, Nassau, 22 June 1903, T. Coffin, 7 F [USNM]; same locality and collector, 24 June 1903, 1 F (*condolescens* holotype) [USNM]. San Salvador Island, 1903, T. Coffin, 4 F [USNM].

**CUBA. Havana:** Havana, 1909, P. Serre, 2 M [USNM]. Havana, 18 Dec 1929, 1 F [USNM]. San Antonio de los Banos, J. Pazos, 1 F [USNM]. **Oriente:** Cayamas, 7 June 1909, E. Schwarz, 4 F [USNM]. Guantanamo Bay, U.S. Naval Base, 8 July 1953, K. Knight, 1 F [UCLA]. **Locality unspecified:** 1914, J. Pazos, 7 F [USNM].

**GRAND CAYMAN ISLAND.** 9 Sept 1968, J. Belkin, E. Gerberg (CAY 111), 4 F [UCLA].

**LITTLE CAYMAN ISLAND.** 13 Sept 1930, H. Peters, 1 F [USNM].

### 11. *Aedes (O.) euplocamus* Dyar and Knab

Figs. 3, 25, 26

1906. *Aedes euplocamus* Dyar and Knab, 1906a:199. TYPE: *Syntypes* larvae, Zent, near Limon, Limon, Costa Rica, F. Knab [NE; see Stone and Knight, 1956:217].

*Aedes (Ochlerotatus) euplocamus* of Levi-Castillo (1951:383; 1952:262); Vargas (1956:22); Stone, Knight and Starcke (1959:145); Belkin, Heinemann and Page (1970:164); in part of Dyar (1925a:144; 1928:167); Edwards (1932:142); Martini (1935:55); Lane (1939:109).

*Aedes (Heteronychia) euplocamus* of Dyar (1920:105).

*Aedes euplocamus* of Howard, Dyar and Knab (1917:787-789); Dyar (1918a:77; 1924a:118-119); Kumm, Komp and Ruiz (1940:400); Kumm and Zuniga (1942:405).

*Aedes (Ochlerotatus) scapularis euplocamus* of Dyar (1922a:59); Bonne and Bonne-Wepster (1925:388-390).

*Aedes (Ochlerotatus) scapularis* of Lane (1951:335); Lane (1953:665-667, in part); Forattini (1965:331, in part).

**FEMALE** (fig. 25). Wing: 3.50 mm. Proboscis: 2.20 mm. Forefemur: 1.80 mm. Abdomen: 2.90 mm. **Head:** Palpus 3 segmented. **Thorax:** Broad anterior scutal stripe entirely silvery white. **Legs:** Knee spots of white scales present posteriorly on apices of femora. Claws of hindleg with submedian tooth. **Abdomen:** Terga II-VII entirely dark scaled dorsally or with small basomedian white scale patches.

**MALE** (fig. 25). Wing: 3.00 mm. Proboscis: 2.15 mm. Forefemur: 1.55 mm. Abdomen: 2.95 mm. **Abdomen:** Terga with basal bands of white scales.

**MALE GENITALIA** (fig. 25). **Segment IX:** Anterior middorsal emargination of tergum broad and shallow, caudal bridge connecting tergal lobes broad; tergal lobes about as broad as high, with 5-7(3-10) setae. **Sidepiece:** Length about 4 times median width; sternomesal margin with about 40-50 long setae; apical tergomesal lobe moderately developed; basal tergomesal lobe relatively small, triangular with anter-



ior and posterior sides subequal in length although often folded ventrad in slide preparations, differentiated seta length about 20 times greatest width, with about 20 undifferentiated setae, usually 4 longer setae projecting distad from posterior edge of lobe. **Claspette:** Stem broadly curved dorsad and narrowed distally, basal seta subequal in length to claspette width at origin of seta; filament subequal in length to stem, narrow at base, abruptly expanded near middle with large retrorse process and several elongate spicules basad of retrorse process, and tapered to re-curved tip. **Clasper:** Spiniform length about 10-14 times its greatest width. **Phallosome:** Aedeagus ovate to slightly pyriform.

**PUPA** (fig. 25). Abdomen: 2.55 mm. Trumpet: 0.50 mm. Paddle: 0.80 mm. **Cephalothorax:** Weakly pigmented, dorsum darker. **Abdomen:** Moderately pigmented. Seta 1-VII usually single (1-2b). Seta 3-VII usually triple (1-3b). Seta 5-IV,V usually considerably longer than length of succeeding tergum; seta 5-VI subequal in length to length of succeeding tergum, single, rarely double. Seta 6-III-VI single, rarely double on segments III, IV, VI.

**LARVA** (fig. 26). Head: 0.80 mm. Siphon: 0.75 mm. Anal Saddle: 0.35 mm. **Thorax:** Spicules of integument moderately numerous and conspicuous, length about 4-6 times basal diameter. Seta 3-P single. Seta 7-P triple (2-3b). **Abdomen:** Seta 1-IV,V usually single (1-3b); seta 1-VII usually double (2-3b). Seta 6-I,II double; seta 6-III-VI single. Seta 13-III well developed, single, subequal to seta 13-IV,V. **Segment VIII:** Comb scales moderate in size, evenly fringed, 20-24 (13-27) in number, in irregular double to triple row. **Siphon:** Index about 2.0 to 2.4. Pecten with teeth evenly spaced, extending slightly beyond middle of siphon. Seta 1-S inserted distad of pecten. **Anal Segment:** Ventral brush (4-X) with 8 pairs of setal tufts.

**SYSTEMATICS.** *Aedes euplocamus* can be separated from the other species of the Scapularis Group by the following characters: in the **female** (1) the scutum has a broad anterior stripe of silvery white scales, (2) knee spots of white scales are present on the apices of the femora, and (3) the palpus is 3 segmented; in the **male genitalia**, generally indistinguishable from *bogotanus*, *trivittatus*, *tortilis*, *condolenscens* and *patersoni*, (1) the sidepiece length is about 4 times median width, (2) the claspette filament is subequal in length to the stem and has a large retrorse process with several elongate spicules basad of the process, the spicules not extending basad of the basal 0.2 of the filament, (3) the sternomesal margin of the sidepiece has 40 to 50 long setae between the basal tergomesal lobe and the clasper, (4) the claspette stem is broadly curved dorsad and not expanded distally, (5) the apical tergomesal lobe of the sidepiece is moderately developed, and (6) the spiniform length is about 10 to 14 times its greatest width; in the **larva** (1) seta 1-IV,V is single, (2) seta 13-III is well developed, subequal to 13-IV,V, (3) seta 3-P is single, (4) seta 6-III is single, and (5) the spicules of the thoracic and abdominal integument are moderately long, length about 4 to 6 times basal diameter.

*Aedes euplocamus* can be separated from the closely related *patersoni* only with some difficulty in the female, male genitalia and larva. The presence of the relatively large fourth palpal segment in the female of *patersoni* and its absence in *euplocamus* is constant in the specimens I have examined, although this character is variable in other species of the Scapularis Group. Although the differentiated seta of the basal tergomesal lobe is somewhat longer and thicker in *patersoni* than in *euplocamus*, the male genitalia are separated primarily by the longer basal seta of the claspette stem of *patersoni*. The separation of the larva is tenuous, seta 6-III being usually double though often single in *patersoni* and always single in *euplocamus*, and the spicules of the integument are longer in *patersoni* than in *euplocamus*.



There is no evidence to indicate how long *euplocamus* and *patersoni* have been geographically isolated; however, evolutionary pressures on neither species have been sufficient to produce significant and morphological changes between the two.

**BIONOMICS.** Larvae and pupae of *euplocamus* have been collected from volcanic streamside rockholes in Costa Rica, in partial shade, the water temporary, the rockholes without vegetation, and associated with several species of *Culex* and *Uranotaenia*. In Venezuela, larvae of *euplocamus* have been collected from a tire with larvae of *Aedes* (*S.*) *aegypti* and pupae from a small, temporary ground pool. Kumm, Komp and Ruiz (1942:405) collected larvae of *euplocamus* in El Salvador only once, in a seepage area at about 900 meters elevation containing abundant algae, although adults were taken often in houses, horse traps, caves and in the forest during the day.

**DISTRIBUTION** (fig. 3). *Aedes euplocamus* is distributed from Veracruz, Mexico through Central America to the Panama Canal Zone, and is also known from Aragua, Venezuela and Meta, Colombia. There are no reliable distribution records in the literature other than the localities included in the following list of specimens examined. Material examined: 186 specimens; 39 males, 73 females, 55 pupae, 19 larvae; 35 individual rearings (7 larval, 26 pupal, 2 incomplete).

**COLOMBIA.** Meta: Locality uncertain, probably near Villavicencio, 8 Nov 1936 (COR 136), 4 F [UCLA].

**COSTA RICA.** Alajuela: Ciruelas, 24 Nov 1920, A. Alfaro, 2 M, 2 F [USNM]. Ciruelas, 26 July 1921, 4 M [USNM]. Rio Alajuela, nr. Atenas, 500 m, 31 July 1971, S. Heinemann and A. Berrios Arias (CR 308), 1 lpF (10), 1 pF (105), 1 lP (11), 1 l, 2 L [UCLA]; same data (CR 309), 1 pM (102), 3 pF (100,101,103), 1 lP (10), 1 F, 1 p, 1 L [UCLA]. Guanacaste: El Coco, 19 July 1962, F. Truxal, 1 F [UCLA]. Heredia: Heredia, 1 M [USNM]. Limon: Matina, 21 May 1925, L. Rozeboom (CRR 6), 1 M [UCLA].

**EL SALVADOR.** San Salvador: San Salvador, F. Figueroa, 1 F [USNM]. Sonsonate: Sonsonate, F. Knab, 1 M, 3 F [UCLA]. Usulután: Berlin, Sept 1941, 4 M, 2 F [USNM]. Locality unspecified: 1 M.

**MEXICO.** Oaxaca: Almoloya, F. Knab, 6 F [USNM]. Matios Romero (42 km N), 26 July 1963, E. Fisher (MF 13), 1 F [UCLA]. Veracruz: Cordoba, 8 Apr 1908, F. Knab, 1 F [USNM].

**PANAMA AND CANAL ZONE.** Canal Zone: Ancon, 18 July 1908, A. Jennings, 1 M [USNM]. Corozal, 24 May 1943, H. Crowell (KO 202C-3), 3 M, 2 F [UCLA]. Corozal, J. Shropshire, 1 F [USNM]. La Pita, 16 Jan 1922, J. Shropshire, 1 F [USNM]. Pedro Miguel 1916, L. Dunn, 1 M, 2 F [USNM]. Locality unspecified (CZ 49), 1 lpF (14), 3 pM (10,101,105), 4 pF (104,106,107,109), 1 M, 1 F, 1 P [UCLA]. Panama: La Chorrera, 1 Feb 1945, R. Arnett and Frick (ASM 400), 4 F [UCLA]. Paitilla Pt., 31 July 1923, H. Dyar and R. Shannon, 5 M, 5 F [BM, USNM].

**VENEZUELA.** Aragua: San Jacinto Mil. Res. (nr. Maracay), 550 m, 17 July 1969, J. Valencia and J. Pulido (VZ 237), 3 M, 12 F, 15 p, 5 l, 1 L [UCLA]. Turmero, 540 m, 29 Aug 1966, E. Vasquez (VZ 26), 4 pM (100,104,107,110), 8 pF (101,105,108,109,111-114), 3 p [UCLA]; same locality and collector, 14 Sept 1966 (VZ 42), 3 lpM (90,96,98), 2 lpF (93,94), 2 pF (92,95) [UCLA]. State unknown: Trinidad, 30 Jan 1939 (VZR 141), 1 F [UCLA].

## 12. *Aedes* (*O.*) *patersoni* Shannon and Del Ponte

Figs. 3,27,28

1928. *Aedes* (*Ochlerotatus*) *patersoni* Shannon and Del Ponte, 1928:73-74. TYPE: Lectotype female, San Pedro de Jujuy, Jujuy, Argentina, 27 Apr 1926, Paterson, Shannon and Shannon [INM; selection of O. H. Casal in Belkin, Schick and Heinemann, 1968:14]. Synonymy with *crinifer* apparently by Edwards (1932:142); resurrected from synonymy with *crinifer* by Del Ponte, Castro and Garcia (1951:229).



*Aedes (Ochlerotatus) patersoni* of Del Ponte, Castro and Garcia (1951:229); Ronderos and Garcia (1963a:35-36); Garcia and Ronderos (1963:29); Stone (1967:207).

*Aedes (Ochlerotatus) crinifer* in part of Edwards (1932:142); Lane (1939:108; 1953:668-669); Stone, Knight and Starcke (1959:143); Forattini (1965:358).

**FEMALE** (fig. 27). Wing: 3.75 mm. Proboscis: 2.45 mm. Forefemur: 1.90 mm. Abdomen: 3.25 mm. **Head:** Palpus 4 segmented, segment 4 relatively large. **Thorax:** Broad anterior scutal stripe entirely silvery white. **Legs:** Knee spots of white scales present posteriorly on apices of femora. Claws of hindleg with submedian tooth. **Abdomen:** Terga II-VII entirely dark scaled dorsally or with small basomedian white scale patches.

**MALE** (fig. 27). Wing: 3.60 mm. Proboscis: 2.40 mm. Forefemur: 1.70 mm. Abdomen: 3.40 mm. **Abdomen:** Terga with bands of white scales.

**MALE GENITALIA** (fig. 27). Essentially as in *euplocamus* with following exceptions: differentiated seta of basal tergomesal lobe of sidepiece somewhat longer and thicker, length about 12 times greatest width; basal seta of claspette stem usually about double in length to claspette width at origin of seta.

**PUPA** (fig. 27). Abdomen: 3.55 mm. Trumpet: 0.60 mm. Paddle: 0.80 mm. **Cephalothorax:** Weakly pigmented, dorsum considerably darker. Seta 9-C usually single (1-2b). **Abdomen:** Moderately pigmented. Seta 1-VII usually single (1-2b). Seta 3-VII usually single (1-2b). Seta 5-IV,V usually longer than length of succeeding tergum. Seta 6-III usually double (1-2b); seta 6-IV-VI usually single (1-2b).

**LARVA** (fig. 28). Head: 0.85 mm. Siphon: 0.80 mm. Anal Saddle: 0.35 mm. **Thorax:** Spicules of integument numerous and conspicuous, length about 8-12 times basal diameter. Seta 3-P single. Seta 7-P triple. **Abdomen:** Seta 1-IV,V single (1-2b). Seta 6-I,II double; seta 6-III double (1-2b); seta 6-IV single (1-2b); seta 6-V, VI single. Seta 13-III well developed, single, subequal to seta 13-IV,V which are single. **Segment VIII:** Comb scales moderate in size, evenly fringed, about 20(18-23) in number, in irregular double to triple row. **Siphon:** Index about 2.1-2.3. Pecten with teeth evenly spaced, extending slightly beyond middle of siphon. Seta 1-S inserted distad of pecten. **Anal Segment:** Ventral brush (4-X) with 8 pairs of setal tufts.

**SYSTEMATICS.** *Aedes patersoni* can be separated from the other species of the Scapularis Group by the following characters: in the **female** (1) the scutum has a broad anterior stripe of silvery white scales, (2) knee spots of white scales are present on the apices of the femora, and (3) the palpus is 4-segmented with segment 4 relatively large; in the **male genitalia**, generally indistinguishable from *bogotanus*, *trivittatus*, *tortilis*, *condolenscens* and *euplocamus*, (1) the sidepiece length is about 4 times median width, (2) the claspette filament is subequal in length to the stem and has a large retrorse process with several elongate spicules basad of the process, the spicules not extending basad of the basal 0.2 of the filament, (3) the sternomesal margin of the sidepiece has 40 to 50 long setae between the basal tergomesal lobe and the clasper, (4) the claspette stem is broadly curved dorsad and not expanded distally, (5) the apical tergomesal lobe of the sidepiece is moderately developed, and (6) the spiniform length is about 10 to 14 times its greatest width; in the **larva** (1) seta 1-IV,V is single, (2) seta 13-III is well developed, subequal to 13-IV,V, (3) seta 3-P is single, (4) seta 6-III is usually double, and (5) the spicules of the thoracic and abdominal integument are long, length 8 to 12 times basal diameter.

This species is morphologically very similar in all stages to *euplocamus*, to which it is undoubtedly closely related. This is discussed above under *euplocamus*.



**BIONOMICS.** Paterson, Shannon and Shannon reared the type series of *patersoni* from larvae collected from a heavily vegetated temporary rain pool which also contained larvae of *Psorophora (J.) ferox* and *Culex (Lutzia)* sp. Data from records of 2 UCLA collections of *patersoni* from Argentina indicate that larvae were obtained from a semipermanent pond associated with *scapularis* and from a temporary roadside pool containing no vegetation and associated with *P. ferox*.

**DISTRIBUTION** (fig. 3). *Aedes patersoni* is known from extreme northern Argentina and southern Bolivia. Material examined: 433 specimens; 64 males, 22 females, 233 pupae, 114 larvae; 49 individual rearings (33 larval, 15 pupal, 1 incomplete).

**ARGENTINA.** Jujuy: San Pedro de Jujuy, 27 Apr 1926, Shannon and Shannon, 1 M, 2 F [USNM]. Salta: Gen. Enrique Mosconi (Campamento Vespucio), 29 May 1969, Fernandez, Garcia and Casal (ARG 742), 2 lpM (11,14), 3 pM (106,108,111), 1 pF (100), 1 F, 30 L [UCLA]; same data (743), 1 F (18) [INM]. Tablillas (nr. Vespucio), 3 June 1969, Fernandez (ARG 755), 2 lpM (25,29), 7 lpF (20-24,26,28), 3 pM (101,104,112), 8 pF (100,102,103,105,106,108,109,113), 1 lp (27), 29 M, 22 F, 178 p, 6 P, 50 L [UCLA].

**BOLIVIA.** Chuquisaca: Muyupampa, 3 June 1944, Carr (3147), 1 F [USNM]. Locality unknown: Carr (2911), 1 F [USNM]; Carr (2921), 2 M [UCLA].

### 13. *Aedes (O.) raymondi* Del Ponte, Castro and Garcia

Figs. 3,32

1951. *Aedes (Ochlerotatus) raymondi* Del Ponte, Castro and Garcia, 1951:235-236. TYPE: Holotype female (587), San Pedro, Jujuy, Argentina, 27 Apr 1926, Shannon and Shannon [INM].

*Aedes (Ochlerotatus) raymondi* of Stone, Knight and Starcke (1959:152); Forattini (1965:368).

**FEMALE** (fig. 32). Wing: 3.25 mm. Proboscis: 2.05 mm. Forefemur: 1.70 mm. Abdomen: 2.90 mm. Thorax: Broad anterior scutal stripe divided by narrow acrostichal line of tan scales. Legs: Knee spots of white scales present on apices of femora. Claws of hindleg with submedian tooth. Abdomen: Terga II-VII with basomedian white scale patches.

**MALE, PUPA, LARVA.** Unknown.

**SYSTEMATICS.** *Aedes raymondi*, very closely related to *euplocamus* and *patersoni*, shares the same habitat with the latter species, having been described from specimens in the type series of *patersoni*. Known only in the female, *raymondi* is separated from *patersoni* and the other species of the Scapularis Group by a single character, a narrow acrostichal line of tan scales dividing the characteristic broad anterior scutal stripe of silvery white scales of the Infirmatus Subgroup. In the absence of contrary evidence from other stages and the presence of this unusual scutal marking, I am recognizing *raymondi* as a distinct species.

**BIONOMICS.** *Aedes raymondi* was described from 2 females from the type series of *patersoni*. The series was reared from larvae collected from a heavily vegetated temporary rain pool with associated larvae of *Psorophora (J.) ferox* and *Culex (Lutzia)* sp.

**DISTRIBUTION** (fig. 3). *Aedes raymondi* is known only from the type locality, Jujuy, Argentina. Material examined: 2 specimens, 2 females.

**ARGENTINA.** Jujuy: San Pedro de Jujuy, 27 April 1926, R. and E. Shannon, 1 F (holotype) [INM]; same data, 1 F [INM].



14. *Aedes (O.) infirmatus* Dyar and Knab

Figs. 3,29,30,31

1906. *Aedes infirmatus* Dyar and Knab, 1906a:190,197. TYPE: Syntypes larvae, Baton Rouge, Louisiana, USA, J. W. Dupree [NE; see Stone and Knight, 1956:219].

*Aedes (Ochlerotatus) infirmatus* of Dyar (1928:166); Edwards (1932:142); Matheson (1944:158-159); Coher (1948:102); Carpenter and LaCasse (1955:199-200); Stone, Knight and Starcke (1959:147); Craig and Horsfall (1960:17); Forattini (1965:323-324); Reinert (1970:148).

*Aedes (Heteronychia) infirmatus* of Dyar (1920:105; 1922b:50-51).

*Aedes infirmatus* of Dyar and Knab (1906b:162); Howard, Dyar and Knab (1917:781-783); Dyar (1918a:77; 1924a:119); Shlaifer and Harding (1946:250); Weathersbee and Arnold (1947:216); Breland (1951:362-371); Breland, Snow and Pickard (1961:288).

*Aedes (Ochlerotatus) scapularis infirmatus* of Dyar (1922a:59); Root (1924:452).

**FEMALE** (figs. 29,30). Wing: 3.75 mm. Proboscis: 2.40 mm. Forefemur: 1.90 mm. Abdomen: 3.30 mm. **Head:** Palpus 3 segmented. **Thorax:** Broad anterior scutal stripe entirely silvery white. **Legs:** Knee spots of white scales absent posteriorly on apices of femora. Claws of hindleg with submedian tooth. **Abdomen:** Terga II-VII entirely dark scaled dorsally.

**MALE** (figs. 29,30). Wing: 3.60 mm. Proboscis: 2.55 mm. Forefemur: 1.70 mm. Abdomen: 3.55 mm. **Abdomen:** Terga without basal bands of white scales although basolateral white scale patches large and prominent on distal segments.

**MALE GENITALIA** (fig. 30). **Segment IX:** Anterior middorsal emargination of tergum relatively broad and deep, caudal bridge connecting tergal lobes narrow; tergal lobes usually broader than high with 5-7(2-7) setae. **Sidepiece:** Length about 3.5 times median width, tergal surface with short setae mesad, longer setae laterad and about 3 subapicotergal setae; sternomesal margin with numerous, about 70-80, long setae; apical tergomesal lobe well developed; basal tergomesal lobe well developed, triangular with anterior and posterior sides subequal, with 20-25 undifferentiated setae of 2 sizes, long dorsally and ventrally and short in center of cluster, usually with 3 or 4 long setae projecting distad from posterior edge of lobe. **Claspette:** Stem uniformly narrow and broadly curved dorsad; filament subequal in length to stem, narrow at base, abruptly expanded near middle with large retrorse process and several elongate spicules basad of retrorse process, and tapered to acute, recurved tip. **Clasper:** Spiniform long, length 12 times its greatest width. **Phallosome:** Aedeagus pyriform.

**PUPA** (fig. 30). Abdomen: 3.35 mm. Trumpet: 0.55 mm. Paddle: 0.95 mm. **Cephalothorax:** Moderately pigmented; leg cases, wing case and dorsum darker. Seta 8-C with 6-8(4-9) branches. **Trumpet:** Strongly pigmented, very dark brown. **Abdomen:** Moderately pigmented, dark brown at base of segment III. Genital lobe considerably darker than segment VIII. Seta 1-IV 4-5(4-7) branched, 1-V 2-4(2-6) branched; seta 1-VII triple (2-5b). Seta 2-VI usually mesad of seta 1-VI. Seta 3-V triple (2-4b). Seta 5-IV,V usually subequal to or slightly shorter than length of succeeding tergum; seta 5-VII 4-5(2-6) branched. Seta 6-III usually triple (3-4b); seta 6-IV 4(2-4) branched; seta 6-V triple (1-3b); seta 6-VI double (2-3b).

**LARVA** (fig. 31). Head: 0.90 mm. Siphon: 0.90 mm. Anal Saddle: 0.45 mm. **Thorax:** Spicules of integument sparse and inconspicuous, short, length about 2-3 times basal diameter. Seta 3-P single. Seta 7-P triple (2-3b). **Abdomen:** Seta 6-I,II double, very rarely triple; seta 6-III-VI single. Seta 13-III strongly developed, single, subequal to seta 13-IV,V which are also single. **Segment VIII:** Comb scales moder-



ate in size, with well-differentiated median spinule, at least  $2\frac{1}{2}$  to 3 times length of submedian spinules, 20-25 in number, in irregular double row. **Siphon:** Index about 2.6-3.0. Pecten with teeth evenly spaced, extending to middle of siphon. Seta 1-S inserted distad of pecten. **Anal Segment:** Ventral brush (4-X) with 8 pairs of setal tufts, the most proximal tuft occasionally arising from within or on margin of saddle.

**SYSTEMATICS.** *Aedes infirmatus* can be separated from the other species of the Scapularis Group by the following characters: in the **female** (1) the scutum has a broad anterior stripe of silvery white scales, (2) there are no knee spots of white scales on the apices of the femora, and (3) the abdominal terga are entirely dark scaled dorsally; in the **male genitalia** the sternomesal margin of the sidepiece has at least 65 and as many as 85 well developed setae between the basal tergomesal lobe and the clasper; in the **larva** (1) the spicules of the thoracic and abdominal integument are short and sparse, length about 2 to 3 times basal diameter, (2) seta 13-III is well developed, single and subequal to 13-IV,V, (3) the siphon index is greater than 2.5, and (4) the median spinule of the comb scales is long, about 3 times the length of the submedian spinules.

Primarily on the basis of distinctive male genitalic characters, *infirmatus* appears to be the most advanced species of the Infirmatus Subgroup. It is also the only Nearctic species in the subgroup, probably invading continental North America from the West Indies.

In most areas where species of the Infirmatus Subgroup are sympatric with other species of the Scapularis Group the former seem to be the less common, an exception being the southeastern United States where *infirmatus* and *trivittatus* of the Trivittatus Subgroup occur together. This may indicate that *infirmatus* became established in this area prior to the probable post-Pleistocene invasion of North America proper by *trivittatus* and has been the more successful competitor.

**BIONOMICS.** *Aedes infirmatus* is found throughout most of the southeastern United States and is abundant in localized areas. It breeds in temporary woodland pools formed by rain or stream overflow and along the grassy edges of permanent marshes and ponds. Most breeding sites contain an abundance of vegetation. There seems to be no preference for either shade or sun. This species overwinters in the egg stage, the larvae hatching in the late spring and adults appearing 2-3 weeks later. Larvae are produced whenever conditioned eggs are covered by rains or floodwaters so a variable number of broods are produced each year. Adults of *infirmatus* will attack whenever their habitat is invaded but are typically more active at dusk.

The egg of *infirmatus* is described and figured by Craig and Horsfall (1960:17) and all larval instars are described by Breland (1951).

The role of *infirmatus* in the transmission of arboviruses is discussed above under Medical Importance.

**DISTRIBUTION** (fig. 3). *Aedes infirmatus* is found throughout the southeastern United States north to Delaware and Missouri and west to Texas. The record of *infirmatus* from Arizona by Rigby (1968:239) refers to *trivittatus*. Material examined: 371 specimens; 60 males, 159 females, 113 pupae, 39 larvae; 37 individual rearings (4 larval, 23 pupal, 10 incomplete).

**UNITED STATES.** **Arkansas:** Scott, 31 Aug 1908, J. Thibault, 8 F [USNM]. **Delaware:** Thompsonville, 21 Aug 1961, R. Lake, 1 L [USNM]. **Florida:** Archbold Bio. Sta., Highlands Co., 13-19 Apr 1970, W. Wirth, 1 F [USNM]. Archer, 31 July 1969, J. Reinert, 1 M, 1 F [JFR]; same locality and collector, 9 Aug 1969, 1 M [JFR]. Astor Park, Lake Co., 10 Nov 1933, 2 M [USNM]. Avon Park, Aug 1943, R. Arnett, 7 F [UCLA]; same locality, 21 May 1944, 1 L



[USNM]; same locality, 2 L [UCLA]. Chantilly Acres, Alachua Co., 25 Apr 1970, W. Wirth, 2 F [USNM]. Everglades N.P., Long Pine Key, 8 July 1971, T. Rogers, S. Chew (FLA 41A), 2 F [UCLA]. Gainesville, 8 Apr-6 Aug 1969, J. Reinert, 24 F [JFR]; same locality and collector, 17 Jan 1970 (69.84), 5 pM (3,12,20,71,73), 8 pF (2,5-7,16,18,22,42), 1 pM, 6 lp, 3 M, 5 F, 21 p, 3 P, 5 l, 1 L [JFR]; same locality and collector, 28 Jan 1970 (70.2), 1 pF, 1 M [JFR]; same locality and collector, 21 Feb 1970 (70.13), 3 p, 2 L [JFR]. Miami, 10 Dec 1921, G. Moznette, 1 F [UCLA]. Micanopy, Alachua Co., 20 Feb 1970, J. Reinert (70.11), 4 L [JFR]; same locality and collector (70.19), 4 pM (2,3,5,26), 4 pF (1,22,23,25), 19 M, 15 F, 12 P, 7 L [JFR]; same locality and collector, 9 Apr 1970 (70.37), 6 M, 5 F, 13 p, 1 P [JFR]; same data (70.38), 1 lp (15), 8 M, 10 F, 16 p [JFR]. Seminole Co., 4 Oct 1937, 2 lp, 2 l [USNM]. St. Joseph's St. Pk., Gulf Co., 1-3 May 1970, W. Wirth, 4 F [USNM]. Tampa, Dyar and Caudell, 1 F [USNM]. Yeehaw Jct., 53 km W Vero Beach, 17 July 1972, T. Rogers (FLA 62), 1 F [UCLA]. **Georgia:** Brooklet, Bullock Co., 20 Sept 1933, 1 F [UCLA]. Hinesville, 29 Sept 1933, 12 F [USNM]. Homerville, 1 Sept 1933, 3 F [USNM]. Savannah, 28 Apr 1951, G. Heid, 1 M, 1 F [UCLA]. St. George, Charlton Co., 30 Aug 1933, 1 M [USNM]. Summerville, 15 May 1934, 2 F [USNM]. **Louisiana:** Alexandria, 31 Mar 1943, W. Wirth, 3 L [USNM]. Baton Rouge, 7 June 1941, W. Wirth, 1 F [USNM]; same locality and collector, 10 May 1942, 2 F [USNM]. Harihan, 30 May 1943, J. Belkin (SE 479), 1 F [UCLA]. New Orleans, 15 Sept 1914, W. King, 2 lpM (218.8,231.1), 2 lpF (218.11,218.12), 1 lp (226.1) [USNM]; same locality, 3 Apr 1927, R. Turner, 2 M, 4 F [USNM, BM]. Norco, 15 Oct 1944, F. Young (ASM 250-7), 15 F [UCLA]. Rapides Co., 1 Apr 1943, W. Wirth, 2 L [USNM]; same locality and collector, 7 Apr 1943, 2 M, 2 F [USNM]; same locality and collector, 4 July 1943, 1 M [USNM]. **Mississippi:** Gulfport, 30 Apr 1929, T. Griffiths, 1 F [USNM]. **Missouri:** Jefferson City, 21 Oct 1926, F. Bingham, 1 F [USNM]. **North Carolina:** [?] Camp Davis, 18 June 1942, 1 L [USNM]. Charlotte, 1920, H. Barret, 1 F [USNM]. Wilmington, 28 Aug 1931, Bishopp, 1 F [USNM]. **South Carolina:** Jasper Co., 20 Apr 1951, 2 F [UCLA]. Kingstree, 26 July 1934, 1 F [USNM]. [?] Stark Gen. Hospital, 23 Aug 1943, Middlekauff, 1 L [USNM]. **Texas:** El Paso, 26 May 1922, R. Tarbett, 3 F [USNM]. **Virginia:** Assateague [Is.], 9, 11 July, 16 Oct 1962, K. Ludlam, 3 F [USNM].

#### Additional Records from the Literature

UNITED STATES. **Illinois:** Massac County (Hayes, 1965:165). **Texas:** Brownsville (Dyar, 1922b:52; McGregor and Eads, 1943:938). Palmetto St. Pk., nr. Luling (Breland (1951:369).

### SCAPULARIS SUBGROUP

**FEMALES. Head:** Occipital dorsolateral dark scale patch reduced or absent. Erect scales usually unicolorous, white. Proboscis usually distinctly paler ventrally. Palpus 4 segmented. **Thorax:** Scutum with large rounded hexagonal patch of light scales from anterior promontory to scutal angle and posteriorly to near level of posterior end of paratergite, often with posterior extensions along dorsocentral line to scutellum and surrounding prescutellar bare space; scales silvery white to yellowish tan. Acrostichal, anterior dorsocentral, and posterior fossal setae absent. **Legs:** Foreleg and midleg with conspicuous white streak posteriorly on femora and basal tarsal segments. Hindleg with conspicuous white stripe on anterior surface of tibia, occasionally nearly encircling tibia, and continued on basal 1 or 2 tarsal segments. Claws with acute submedian tooth. **Wing:** Small patch of white scales present at extreme base of costa and often remigium. **Abdomen:** Terga II-VII with large basolateral white patches and basomedian patches of pale scales, more obvious posteriorly and often forming an indistinct longitudinal line.



**MALES.** Thorax: Anterior scutal scale patch of light scales similar to female though often somewhat reduced in extent laterally. **Legs:** White stripe on anterior surface of hindtibia and basal tarsal segments often inconspicuous. Posterior claw of foreleg moderately enlarged, with acute subbasal tooth. **Abdomen:** Terga dark scaled dorsally.

**DISCUSSION.** The Scapularis Subgroup is characterized in the female by a large usually hexagonal patch of yellowish tan to white scales on the anterior of the scutum, a stripe of white scales on the anterior surface of the hindtibia and usually an indistinct longitudinal stripe of light scales on the abdomen. In the male genitalia, the claspette filament lacks or has a very small retrorse process on the convex margin and the apical tergomesal lobe is moderately to well developed.

The Scapularis Subgroup consists of 3 species, the abundant and widely distributed *scapularis*, *phaeonotus* from the island of Grenada in the Lesser Antilles and *comitatus* from the vicinity of Villavicencio, Colombia. *Aedes phaeonotus* is known in all stages and differs from *scapularis* primarily in the color of the anterior scutal scales of the adult. Known from only 2 males, *comitatus* has distinctive male genitalia as pointed out in the species diagnoses.

### 15. *Aedes (O.) phaeonotus* Arnell, sp. n.

Figs. 4,33,34

**TYPES.** *Holotype* female with associated larval and pupal skins (GR 104-102), Chantimelle Village, near Sauteurs, St. Patrick Parish, Grenada, elev. 200 m, larva taken from temporary stream pool, 30 Oct 1963, R. Martinez [USNM]. *Allotype* male with genitalia slide (730813-2) (GRR 82), Grenada, locality unspecified, 1929 [USNM]. *Paratypes:* 1 F (GRR 21), Belair School, St. Andrew Parish, Grenada, 8 July 1929; Grenada, locality unspecified, 1 M, 3 F (GRR 25), 8 July 1929; 9 M, 10 F (GRR 30), 10 July 1929; 1 F (GRR 54), 16 July 1929; 1 M (GRR 75a), 23 July 1929; 4 M, 16 F (GRR 82), 1929; 7 M, 1 F (GRR 139), 21 Aug 1929, F. Root [UCLA, BM, FH].

**FEMALE** (fig. 33). Wing: 3.00 mm. Proboscis: 2.20 mm. Forefemur: 1.55 mm. Abdomen: 2.65 mm. Thorax: Hexagonal patch of light scales on anterior of scutum yellow to yellowish tan.

**MALE** (fig. 33). Wing: 3.10 mm. Proboscis: 2.40 mm. Forefemur: 1.55 mm. Abdomen: 3.15 mm. Generally similar to female except for sexual differences.

**MALE GENITALIA** (fig. 33). **Segment IX:** Anterior middorsal emargination of tergum broad and relatively deep, caudal bridge connecting tergal lobes narrower than distance between lobes; tergal lobes about as broad as high, with 4 or 5 setae. **Sidepiece:** Length about 4 times median width; tergal surface with setae relatively long, and 3 or 4 subapicotergal setae; sternomesal margin with 30-40 setae; apical tergomesal lobe well developed; basal tergomesal lobe well developed, broadly conical, with about 15 undifferentiated setae, most on ventral surface of lobe. **Claspette:** Stem uniformly narrow and broadly curved dorsad; filament slightly longer than stem, narrow at base, expanded near middle, and tapered to acute tip. **Clasper:** Spiniform length about 10 times its greatest width. **Phallosome:** Aedeagus ovate to slightly pyriform.

**PUPA** (fig. 33). Abdomen: 2.75 mm. Trumpet: 0.40 mm. Paddle: 0.65 mm. Cephalothorax: Weakly pigmented. Seta 10-C 9-10 branched. Trumpet: Weakly pigmented, light yellowish brown in color. Abdomen: Weakly pigmented; base of segments III and IV darker. Seta 3-V single; seta 3-VII double. Seta 6-III-VI single.

**LARVA** (fig. 34). Head: 0.80 mm. Siphon: 0.70 mm. Anal Saddle: 0.30 mm.



**Thorax:** Spicules of integument numerous and conspicuous, length about 6-10 times basal diameter. Seta 3-P single or double. Seta 7-P triple. **Abdomen:** Seta 1-III 6,8 branched; seta 1-IV,V strongly developed, single. Seta 6-I,II double; seta 6-III-VI single. Seta 8-II single. Seta 13-III strongly developed, single, subequal to seta 13-IV,V which are single. **Segment VIII:** Comb scales moderate in size, evenly fringed, about 22 in number, in irregular double to triple row. **Siphon:** Index about 2.25. Pecten with teeth evenly spaced, extending to middle of siphon. Seta 1-S inserted distad of pecten. **Anal Segment:** Ventral brush (4-X) with 9 pairs of setal tufts.

**SYSTEMATICS.** *Aedes phaeonotus* can be separated from the other species of the Scapularis Group by the following characters: in the **female** (1) the anterior surface of the hindtibia and basal hindtarsal segments has a conspicuous stripe of white scales and (2) the large light scale patch on the anterior scutum is yellow to yellowish tan; in the **male genitalia**, indistinguishable from *scapularis*, (1) the claspette filament is subequal in length to the claspette stem and without or with a very minute retrorse process, (2) the apical tergomesal lobe of the sidepiece is moderately developed, and (3) there is no enlarged undifferentiated seta ventrally on the basal tergomesal lobe of the sidepiece; in the **larva** (1) seta 3-P is at least triple, (2) seta 5-C is single, (3) the siphon has no ventroapical prolongation, and (4) seta 1-III is multiple (6-8 branched).

Although common and very widely distributed, *scapularis* is apparently absent from Puerto Rico, the Virgin Islands and the Lesser Antilles. The Scapularis Subgroup is, however, represented on Grenada, one of the southernmost of the Lesser Antilles, by *phaeonotus*, distinguishable from *scapularis* in the female by the yellow to yellowish tan anterior scutal scale patch, and, tenuously, in the larva by the more branched seta 1-III. I have seen only one larva of *phaeonotus* and this character may not hold when more specimens are examined.

*Aedes scapularis* is common in Trinidad, Tobago and adjacent northern South America. The presence of distinct but closely related species on Trinidad and Grenada is found in other aedines, for example *busckii* and *ioliota* of *Aedes* (*Howardina*) and *splendens* and *celeste* of *Haemagogus* (*H.*).

**BIONOMICS.** The holotype larva of *phaeonotus* was taken in seasonal deciduous forest from a temporary stream pool covered with surface scum. Other species associated with *phaeonotus* were *Anopheles* (*N.*) *argyritarsis*, *Culex* (*Mel.*) *jocasta* and *Psorophora* (*G.*) sp near *cingulata*. The allotype and paratype adult collections, locality unknown, were made during a 1929 malarial survey of Grenada (Root and Andrews, 1938).

**DISTRIBUTION** (fig. 4). *Aedes phaeonotus* is known only from the island of Grenada in the Lesser Antilles. Material examined: 58 specimens; 23 males, 33 females, 1 pupa, 1 larva; 1 individual rearing (larval).

**GRENADA.** Type series, see above.

## 16. *Aedes* (*O.*) *scapularis* (Rondani)

Figs. 4,35,36,37

1848. *Culex scapularis* Rondani, 1848:109. TYPE: Female(s), Brazil, locality unspecified; TYPE LOCALITY here corrected to vicinity of Belem (Para) [possibly NAPLES]. See discussion below under systematics.

1891. *Ochlerotatus confirmatus* Lynch Arribalzaga, 1891:146. TYPE: *Lectotype* female, Na-



- varro, Buenos Aires, Argentina, May 1887, F. Lynch Arribalzaga [BA; selection of O. H. Casal in Belkin, Schick and Heinemann, 1968:14]. Synonymy with *scapularis* by Blanchard (1905:335).
1906. *Aedes hemisurus* Dyar and Knab, 1906a:199. TYPE: *Larva*, Kingston, Jamaica; based on figure in Grabham (1905:405) [NE; see Stone and Knight, 1956a:218]. Synonymy with *scapularis* by Howard, Dyar and Knab (1917:787). Resurrected from synonymy with *scapularis* by Belkin, Heinemann and Page (1970:161). NEW SYNONYMY.
1907. *Aedes indolezens* Dyar and Knab, 1907:11-12. TYPE: *Holotype* female, Cayamas, Cuba, May, E. A. Schwarz [USNM, 10249; see Stone and Knight, 1956:219]. Synonymy with *hemisurus* and *scapularis* apparently by Howard, Dyar and Knab (1917:787).
1918. *Aedes (Ochlerotatus) camposanus* Dyar, 1918b:128-129. TYPE: *Lectotype* male, Guayaquil, Guayas, Ecuador, date not specified, F. Campos Ribadeneira [USNM, 21916; selection of Stone and Knight 1956:216]. Synonymy with *euplocamus* apparently by Dyar (1925a:144). Resurrected from synonymy with *euplocamus* by Levi-Castillo (1951:383). NEW SYNONYMY.
1933. *Aedes (Ochlerotatus) rhyacophilus* Lima, 1933:404-407. TYPE: *Syntypes* males, females with larval exuviae and pupae, Valle do Chanaan, Esperito Santo, Brazil, 1932, J. Serafim (TYPE LOCALITY restricted to Sao Joao de Petropolis by Belkin, Schick and Heinemann, 1971:19) [LU]. NEW SYNONYMY.

*Aedes (Ochlerotatus) scapularis* of Bonne-Wepster and Bonne (1923:126); Dyar (1923:181-182; 1928:167-168, in part); Shannon and Del Ponte (1928:73,121-122); Shannon (1931a:7; 1931b:149); Kumm (1931:56-57); Edwards (1932:142); Soper, Penna et al. (1933:576); Lane (1939:112-114; 1953:665-667, in part); Cerqueira (1943:32; 1961:145); Matheson (1944:159-160); Coher (1948:101-102); Levi-Castillo (1952:262); Carpenter and La Casse (1955:224-226); Duret and Barreto (1956:89); Perez Viguera (1956:286-295); Vargas (1956:23); Rachou, Lima et al. (1958:417); Stone, Knight and Starcke (1959:153); Fauran (1961:26); Garcia and Ronderos (1963:29); Prosen, Carcavallo and Martinez (1964:101-102); Forattini (1965:331-341, in part); Montchadsky and Garcia Avila (1966:29,75); Porter (1967:37-40); Xavier and Mattos (1970:445-446); Belkin, Heinemann and Page (1970:164).

*Aedes (Heteronychia) scapularis* of Dyar (1920:105).

*Aedes scapularis* of Howard, Dyar and Knab (1917:783-787); Dyar (1918a:77; 1921:150); Evans (1921:445-446); Martini (1931a:118; 1931b:204); Prado (1931:201); Komp (1936:62); Del Ponte, Castro and Garcia (1951:236); Komp (1956:38); Torre y Callejas, Alayo Delmau and Calderon Chapman (1961:68-69); Mattos and Xavier (1965:278); Garcia Avila and Gutsevich (1969:6); Morales-Ayala (1971:142).

*Culex scapularis* of Hunter (1900:281); Blanchard (1905:335); Lutz, de Sousa Araujo and da Fonseca Filho (1919:86).

*Leucomyia scapularis* of Theobald (1910:315); Surcouf and Gonzalez-Rincones (1911:160); Lutz and Nunez Tovar (1928:37).

*Aedes (Ochlerotatus) scapularis scapularis* of Dyar (1922a:57-59); Bonne and Bonne-Wepster (1925:388-390).

*Aedes scapularis scapularis* of Dyar (1924a:118).

*Ochlerotatus confirmatus* of Hunter (1900:280); Coquillett (1906b:19,21).

*Culex confirmatus* of Theobald (1901:42-44; 1903a:191; 1905:26); Giles (1902:443-444); Lutz (1904a:7; 1904b:4); Theobald and Grabham (1905:25); Aiken (1907:68).

*Aedes scapularis hemisurus* of Dyar (1924a:118); Root (1927:465).

*Aedes (Ochlerotatus) hemisurus* of Belkin, Heinemann and Page (1970:161-165).

*Aedes hemisurus* in part of Dyar and Knab (1906b:162).

*Aedes (Ochlerotatus) camposanus* of Levi-Castillo (1951:383; 1952:262); Stone, Knight and Starcke (1959:140); Forattini (1965:337); Belkin, Heinemann and Page (1970:164).

*Aedes (Ochlerotatus) rhyacophilus* of Soper, Penna et al. (1933:575); Lane (1953:671-673); Stone, Knight and Starcke (1959:152); Forattini (1965:368); Garcia and Casal (1968:108).

*Aedes (Ochlerotatus) euplocamus* of Dyar (1925a:144, in part; 1928:167, in part); Edwards



(1932:142, in part); Martini (1935:55, in part); Lane (1939:109, in part); Pritchard, Seabrook and Mulrennan (1947:11).

*Aedes euplocamus* of Dyar and Knab (1906b:162, in part); Del Ponte, Castro and Garcia (1951:236).

*Aedes (Ochlerotatus) condolezens* in part of Martini (1935:54-55).

*Aedes condolezens* of Martini (1931b:204); Morales-Ayala (1971:141).

*Aedes angustivittatus* of Komp (1936:62; 1956:38).

**FEMALE** (figs. 35,36). Wing: 3.10 mm. Proboscis: 2.10 mm. Forefemur: 1.50 mm. Abdomen: 2.55 mm. Thorax: Hexagonal patch of light scales on anterior of scutum silvery white, often yellow to tan on lateral border.

**MALE** (figs. 35,36). Wing: 2.70 mm. Proboscis: 2.20 mm. Forefemur: 1.40 mm. Abdomen: 2.80 mm. Generally similar to female except for sexual differences.

**MALE GENITALIA** (fig. 36). **Segment IX**: Anterior middorsal emargination of tergum broad and usually deep, though occasionally relatively shallow; caudal bridge connecting tergal lobes usually narrower than distance between lobes; tergal lobes about as broad as high, with 3-6(2-8) setae. **Sidepiece**: Length about 3.5-4.0 times median width; tergal surface with short to relatively long, uniformly distributed setae, and 2 or 3 subapicotergal setae; sternomesal margin with 30-40 setae; apical tergomesal lobe moderately developed; basal tergomesal lobe moderately developed, triangular with anterior and posterior sides subequal, often folded ventrad in slide preparations, with about 12-20 undifferentiated setae, those in center of cluster shorter, and 3-4 longer setae projecting distad from posterior edge of lobe. **Claspette**: Stem uniformly narrow and broadly curved dorsad; filament subequal in length to stem, narrow at base, expanded near middle into broadly obtuse outer angle, often with small retrorse process, and tapered to acute, recurved tip. **Clasper**: Spiniform length about 10 times its greatest width. **Phallosome**: Aedeagus ovate to pyriform.

**PUPA** (fig. 36). Abdomen: 2.60 mm. Trumpet: 0.45 mm. Paddle: 0.75 mm. Cephalothorax: Weakly pigmented. Seta 10-C usually 3-4(2-7) branched. **Abdomen**: Weakly pigmented; base of segments III and IV slightly darker. Seta 3-VII usually single (1-2b). Seta 6-III-VI single, very rarely double.

**LARVA** (fig. 37). Head: 0.80 mm. Siphon: 0.80 mm. Anal Saddle: 0.35 mm. Thorax: Spicules of integument numerous and conspicuous, length about 6-10 times basal diameter. Seta 3-P usually double (2-5b). Seta 7-P triple (2-4b). **Abdomen**: Seta 1-III usually triple (3-5b); seta 1-IV,V strongly developed, single. Seta 6-I,II double (1-3b); seta 6-III-VI single (rarely double). Seta 8-II single (rarely double). Seta 13-III strongly developed, single, subequal to 13-IV,V which are single. **Segment VIII**: Comb scales moderate in size, evenly fringed, 20-24 (12-32) in number, in irregular double to triple row. **Siphon**: Index about 2.0-2.6. Pecten with teeth evenly spaced, extending slightly beyond middle of siphon. Seta 1-S inserted slightly distad of pecten. **Anal Segment**: Ventral brush (4-X) with 8 pairs of setal tufts.

**SYSTEMATICS**. *Aedes scapularis* can be separated from the other species of the Scapularis Group by the following characters: in the female (1) the anterior surface of the hindtibia and basal hindtarsal segments has a conspicuous stripe of white scales and (2) the large light scale patch on the anterior scutum is white; in the male genitalia, indistinguishable from *phaeonotus*, (1) the claspette filament is subequal in length to the claspette stem and without or with a very minute retrorse process,



(2) the apical tergomesal lobe of the sidepiece is moderately developed, and (3) there is no enlarged undifferentiated seta ventrally on the basal tergomesal lobe of the sidepiece; in the larva (1) seta 3-P is at least double, (2) seta 5-C is single, (3) the siphon has no ventroapical prolongation, and (4) seta 1-III is usually triple.

I consider *scapularis* to be a single species extending from the southwestern United States through Central and South America to Argentina with an intrusion into the Greater Antilles. I am reducing *hemisurus* from Jamaica and the Greater Antilles, *camposanus* from western South America and *rhyacophilus* from southeastern Brazil to the synonymy of *scapularis*. These species have been considered to be distinct from *scapularis* on the basis of variation in the scutal ornamentation of the female and details of the male genitalia.

The light scale patch on the anterior of the scutum of *scapularis* varies from being straight from the anterior promontory to the scutal angle with few dark brown scales between the light scale patch and the anterolateral scutal margin to being concave to a greater or lesser degree with a proportionately larger number of dark brown scales in the concavity. I find that these differences are a matter of individual variation with the entire range of variation appearing in most populations, although the frequency may be clinal, the populations from Central America and the West Indies having fewer individuals with a reduction in white scutal scaling and those from South America having more. The extent of white scaling on the hindtibia shows slight individual variation as does the presence or absence of a small retrorse process on the outer angle of the claspette filament of the male genitalia. These variations appear to be strictly characteristic of individuals rather than populations.

*Aedes scapularis* is the most common and widely distributed species of the Scapularis Group and one of the most widely distributed mosquitoes in the New World. It is probably one of the more advanced species in the Scapularis Group, as evidenced not only by its distribution and abundance, but also, in comparison with other members of the group, modern morphological characters such as light scales on the hindtibia and reduction of the retrorse process on the claspette filament of the male genitalia.

Belkin, Schick and Heinemann (1971:20,41) restricted the type locality of *scapularis* to the vicinity of Rio de Janeiro, Brazil; however, Papavero (1971-1973:341-343) evidences that the entomological collections from which Camillo Rondani described *scapularis* were made during a 3 month period in the summer of 1846 in the immediate vicinity of Belem by Vittore Ghiliani. I am therefore correcting the type locality to the vicinity of Belem, Para, Brazil. Belkin (1968:7,53,56) states that the location of the type series of *scapularis* is unknown, though possibly in the Instituto di Zoologia, Bologna. Nelson Papavero (1975, *in litt.*) indicates that part of the Rondani collection, possibly including the types of *scapularis*, may be either in the Instituto di Zoologia, Naples or in the possession of the Rondani family.

**BIONOMICS.** *Aedes scapularis* is found at low to moderate elevations throughout most of tropical and subtropical America. It breeds in a wide variety of temporary or semipermanent freshwater situations, primarily temporary rain-filled or stream overflow pools but including pond and swamp margins, rockholes and crabholes, in either sun or partial shade. Associated with larvae of *scapularis* are a wide variety of species of *Anopheles*, *Uranotaenia*, *Culex*, *Psorophora* and *Aedes*. In temporary, grassy, rain-filled pools near Rio de Janeiro, Brazil, the most common mosquito associates were *Psorophora* (J.) sp, *P. (P.) ciliata* and *Culex* (C.) sp. In Jamaica, *scapularis* is most often found with *tortilis*.



Females of *scapularis* attack man readily, and though primarily crepuscular, will bite anytime they are disturbed. Forattini (1961) presents evidence that in areas of prolonged association with man, *scapularis* is adapting to human habitations and is becoming more concentrated around dwellings in rural and semirural areas, even entering buildings to bite. Causey and Kumm (1948) recaptured marked females of *scapularis* 4.1 km from the point of release in a forested area of Brazil, indicating a relatively large dispersal range for this species.

*Aedes scapularis* is by far the most important species of the Scapularis Group in the transmission of disease organisms, and this aspect of its biology is discussed above under Medical Importance.

**DISTRIBUTION** (fig. 4). *Aedes scapularis* extends from the Rio Grande Valley of Texas through the Atlantic lowlands of Mexico to Honduras, the Pacific lowlands of Guatemala to northern Costa Rica; the Bahamas and Greater Antilles except for Puerto Rico; and throughout South America at low and moderate elevations with the exception of Chile and southern Argentina. Material examined: 3601 specimens; 531 males; 1635 females, 668 pupae, 767 larvae; 305 individual rearings (183 larval, 106 pupal, 16 incomplete).

**ARGENTINA.** Buenos Aires: Otamendi (nr. Campana), 22 Mar 1969, O. Casal (GA 697), 4 pM (101-103,105), 1 pF (106) [INM]. Chaco: Quitilipi, May 1952, 1 M, 3 F [USNM]. Resistencia, 21-26 Feb 1927, R. Shannon, 8 F [USNM]. Resistencia, H. Parker, 6 F [USNM]. Formosa: [Puesto] El Coati, May 1950, 1 M, 1 F [USNM]. Jujuy: Calilegua, 5 May 1926, R. Shannon, 3 F [USNM]. Ledesma, 19 Mar 1926, N. Davis and R. Shannon, 1 F [USNM]. San Pedro de Jujuy, 28 Apr 1926, R. Shannon, 48 L [USNM]. Mendoza: Mendoza, 5 Jan 1927, F. and M. Edwards, 1 F [BM]. Misiones: Iguazu, 5 Oct 1927, R. and E. Shannon, 1 M, 2 F [USNM]. Posadas, 13-15 Jan 1927, F. and M. Edwards, 1 F [BM]. Salta: Balbuena (nr. Tartagal), 4 June 1969, Garcia, Casal and Fernandez (GA 764), 3 pM (101,102,106), 1 pF (103) [INM]. Campo del Cuervo (nr. Tartagal), 4 June 1969, Garcia, Casal and Fernandez (GA 763), 1 pM (101), 2 pF (104,105) [INM]. Embarcacion, 4 May 1926, R. Shannon, 4 F [USNM]. Gen. Enrique Mosconi (Campamento Vespucio), 29 May 1969, Fernandez, Garcia and Casal (ARG 742), 5 lpM (12,18,19,27,28), 5 lpF (13,17,22,24,29), 6 pM (10,21,102,104,107,113), 6 pF (15,20,101,109,110,112), 1 lp (23), 2 F, 1 P, 6 L, 50 L [UCLA]; same data (GA 743), 2 lpM (14,15), 1 lpF (12) [INM]; same data (GA 744), 7 pM (104,105,108,110,111,113,114), 5 pF (103,106,107,109,112), 1 M [INM]; same locality, 5 June 1969, Garcia (GA 765), 2 pF (100,101) [INM]; same locality, Mosconi Airport, 29 May 1969, Garcia and Fernandez (GA 746), 1 pF (113) [INM]. Santa Victoria, May 1960, 1 F [USNM]. Tablillas (nr. Vespucio), 5 June 1969, Casal, Garcia and Fernandez (GA 759), 2 lpF (11,14), 2 pM (12,101) [INM]. Tartagal R., Tartagal, 31 May 1969, Garcia and Casal (GA 747), 2 lpF (13,14), 5 pM (102-104,110,112), 4 pF (100,106,109,114) [INM]; same data (GA 753), 1 M [INM]. Tucuman: Monteros, 12 Mar 1926, R. Shannon, 1 M [USNM]. Vipos, 4 Feb 1927, R. Shannon and E. Del Ponte, 5 F [USNM]. Vipos, 3 Apr 1927, E. Del Ponte, 1 L [USNM].

**BAHAMA ISLANDS.** Andros Island, 26 June 1903, T. Coffin, 1 F [USNM].

**BELIZE.** Belize: Belize, 0 m, 11 Aug 1967, D. Bertram (BH 443), 1 F [UCLA]. Belize (mile 25 west), 30 m, 10 July 1967, D. Bertram (BHA 269), 1 F [UCLA]. Freetown, 6 m, 16 Mar 1967, D. Bertram (BHA 57), 4 F [UCLA]. Ladyville (nr. Stanley Airport), 0 m, 31 July 1967, D. Bertram (BH 362), 2 F [UCLA]. Maskalls, 180 m, 30 July 1970, K. and D. Schroeder (BH 506), 1 F [UCLA]. Cayo: Central Farm, 70 m, 30 July 1967, D. Bertram (BH 360), 1 F [UCLA]; same locality and collector, 17 Aug 1967 (BH 479), 1 F [UCLA]. Roaring Creek, 70 m, 28 July 1967, D. Bertram (BH 350), 1 F [UCLA]; same locality and collector, 8 Aug 1967 (BH 396), 1 F [UCLA]; same locality and collector, 9 Aug 1967 (BH 435), 1 F [UCLA]; same data (BH 436), 1 F [UCLA]. Stann Creek (mi 49 on Hummingbird Hwy), 180 m, 9 Aug 1967, D. Bertram (BH 426), 1 F [UCLA].

**BOLIVIA.** Beni: Baures, W. Komp, 2 F [USNM]. L. Rogagua, Nov 1921, W. Mann, 2 F [USNM]. Rio Matos, 25 Sept 1943, Carr (3059), 12 F [USNM]. San Borja, 6 Oct 1943, Carr



(3061), 4 F [USNM]. San Ignacio, 18 Sept 1943, W. Komp (KO 202A-18), 28 F [UCLA]. San Joaquin, 6 June 1964, P. Woke, 5 F [USNM]. Santa Clara, 27 Oct 1943, 3 F [USNM]. **Santa Cruz:** Cercado, Jan 1939, 1 F [USNM]. Rincon de Palometas, Sara, 22 Jan 1944, Carr (3101), 3 F [USNM]. Santa Cruz, 21 Feb 1953, J. Munro, 4 F [USNM]; same locality, 26 Jan 1944, 3 F [USNM]. **Locality unspecified:** Carr, 1 F (2765B), 1 F (2773B), 1 F (2778), 1 F (2783A), 1 F (2783B), 3 F (2784), 2 F (2785A), 1 F (2785B), 2 F (2785D), 3 F (2786A), 1 F (2793A), 1 F (2797), 1 F (2840), 3 F (2844), 2 F (2845), 1 F (2847), 3 F (2848), 1 F (2849), 1 F (2852), 2 F (2855), 3 F (2863), 1 F (2867), 3 F (2868A), 7 F (2870), 1 F (2871), 1 F (2873), 1 F (2875), 1 F (2881), 5 F (2884), 2 F (2898), 1 F (SFA 2971), 1 F (SFA 2972), 1 F (SFA 2974), 2 F (SFA 2975), 1 F (SFA 2976), 2 F (SFA 2977), 1 F (SFA 3027A), 2 F (SFA 3027C), 2 F (SFA 3929C), 1 F (SFA 3030A), 1 F (SFA 3038A), 5 F (SFA 3038C), 1 F (SFA 3039A), 3 F (SFA 3042B) [UCLA, USNM].

**BRAZIL. Bahia:** Aratu, P. MacCreary, 1 F [USNM]. Caravelas, May 1944, MacCreary and Bricker, 1 M [USNM]. Piraja, 11 Apr 1929, R. Shannon, 1 lp, 3 M, 24 F [UCLA, USNM]; same locality, Feb-Mar 1929, N. Davis and R. Shannon, 9 M, 2 F [USNM]; same locality, 1930, R. Shannon, 1 M [USNM]; same locality, 2 Nov, R. Shannon, 1 M [USNM]. Salvador, 1972, J. Fowler (BRS 164), 3 L [UCLA]; same data (BRS 183), 2 L [UCLA]; same data (BRS 274), 3 L [UCLA]; same data (BRS 281), 1 L [UCLA]. Salvador, Dec 1928, R. Shannon, 1 M [USNM]. Salvador, H. Kumm, 3 M [BM]. **Espirito Santo:** Vale do Canaan, May 1932, 2 F [USNM]. **Mato Grosso:** Chapada, 600 m, Ponce and Lane, 1 M, 3 F [UCLA]. Maracaju, July 1938, 6 M, 9 F [UCLA]. Salobra, July 1939, 1 F [UCLA]. **Para:** Belem, APEG Forest, 24 Sept 1970, T. Aitken et al., 11 M [UCLA]; same locality and collectors, 29-30 Sept 1970, 1 F [UCLA]; same locality and collectors, 8 Oct 1970, 1 M [UCLA]; same locality and collectors, 22 Oct 1970, 1 M [UCLA]. Belem, 30 m, 29 Sept 1970, T. Aitken (BRA 57), 1 M [UCLA]. Belem, 11 Apr 1941, W. Komp (KO 202A-35), 1 F [UCLA]. [?] Belem, Durham, 2 F [BM]. **Rio de Janeiro:** Iguassu, Aug 1938, R. Shannon, 1 F [USNM]. Jacarepagua, 0 m, 29 Dec 1975, J. Belkin, M. Faran, G. Bryce (BRA 237), 2 lpM (10,11), 3 lpF (12-14), 3 pM (100,101,103), 5 pF (102,104-107), 1 lP (15) [UCLA]; same data (BRA 238), 3 lpM (10,11,14), 16 lpF (12, 13,15-19,90-98), 4 pM (102-105), 1 pF (100), 22 M, 13 F, 123 P, 1 p, 123 L [UCLA]; same data (BRA 239), 4 lpM (11,12,15,16), 4 lpF (10,13,14,17), 1 pM (101), 1 pF (100), 1 L [UCLA]. Niteroi, 0 M, 6 Jan 1976, J. Belkin et al. (BRA 266), 1 lpM (10), 1 lpF (11) [UCLA]. Petropolis, May 1938, R. Shannon, 1 M [USNM]. Rio de Janeiro, 9 Dec 1899, C. Moreira, 4 F [BM]; same locality, Sept 1938, 3 M [USNM]. Rio de Janeiro, Ilha do Fundao, 0 M, 28 Dec 1975, J. Belkin, M. Faran, G. Bryce (BRA 235), 7 lpM (20-26,70), 4 lpF (20,27-29), 2 L [UCLA]; same data (BRA 236), 6 lpM (20-22,27-29), 11 lpF (11,23,24,26,41-45,49,51), 6 pM (100-105), 2 lP (25, 50), 84 M, 94 F, 1 P, 196 p, 53 L, 132 l [UCLA]; same locality and collectors, 29 Dec 1975 (BRA 240), 14 M, 28 F [UCLA]. Santa Cruz, L. Fajardo, 1 F [BM]. **Rio Grande do Norte:** Natal, 5 Aug 1943, MacCreary and Bricker, 1 M, 3 F, 1 L [USNM]. **Santa Catarina:** Nova Teutonia, 10 July 1938, F. Plaumann, 1 F [BM]. **Sao Paulo:** Itaquaquecetuba, 23 Jan, C. Townsend, 1 F [USNM]. Sao Paulo, A. Lutz, 1 F [USNM]. Locality unspecified (BRAP 411), 1 M, 2 F [UCLA].

**COLOMBIA. Antioquia:** Medellin, 1923, L. Dunn, 1 F [USNM]. Turbo, 27 May 1943, 1 F [USNM]. **Cordoba:** Carillo (nr. San Pelayo), 20 m, 15 July 1965, Incora (COB 80), 2 lpM (12, 13), 3 lpF (10,11,14), 1 F, 1 L [UCLA]. Monteria (13 km N), 4 Oct 1969, W. Page (COL 419), 39 F [UCLA]; same data (COL 420), 15 F [UCLA]; same locality and collector, 5-6 Oct 1969 (COL 422), 2 F [UCLA]. San Carlos, 80 m, 16 July 1969, Incora (COB 82), 4 lpM (10,11,13, 14), 2 lpF (12,15) [UCLA]. San Pelayo, 20 m, 15 July 1965, Incora (COB 81), 4 lpM (10,21,31, 34), 5 lpF (11,12,20,30,32), 2 F, 4 L [UCLA]. **Magdalena:** El Banco, 1 Dec 1943, L. Pinzon (COT 50), 1 F [UCLA]. **Santander:** Lebrija, 10 Apr 1966, C. Marinkelle (COM 64A), 1 F [UCLA]; same locality and collector, 11 Apr 1966 (COM 64B), 3 F [UCLA]. **Valle del Cauca:** Buenaventura, Feb 1940, W. Komp, 3 M, 7 F [USNM]. **Locality unspecified:** (COR 175), 1 F [UCLA]; (COR 484), 1 F [UCLA]; (COR 485), 1 F [UCLA]; (COR 497), 1 F [UCLA].

**COSTA RICA. Guanacaste:** Palo Verde OTS Sta., 10 m, 18 Aug 1971, S. and D. Heinemann (CR 448), 1 F [UCLA]; same locality, 20 June 1975, J. Hayes (CR 602), 6 F [UCLA].



CUBA. **Havana:** Havana, Dec 1903, J. Taylor, 1 M, 2 F [USNM, BM]. Havana, 1909, P. Serre, 1 F [USNM]. Marianao, Apr 1936, H. Carr, 1 M, 6 L [USNM]. San Antonio de los Banos, J. Pazos, 3 F [USNM]. **Oriente:** Cayamas, E. Schwarz, 5 F [USNM]. Cayamas, 8 May 1906, E. Schwarz, 1 F (*indolenscens* holotype) [USNM]. Levisa (nr. Nicaro), 9 July 1953, K. Knight (379), 1 F [UCLA].

DOMINICAN REPUBLIC. **Dajabon:** Dajabon, 38 m, 10 July 1971, T. Rogers (RDO 110), 1 F [UCLA]; same locality, 40 m, 11 July 1971, T. Rogers (RDO 111), 1 L [UCLA]; same data (RDO 114), 1 lpM (18), 2 lpF (16,17), 2 lP (10,11), 1 M [UCLA]. **Distrito Nacional:** San Felipe, 39 m, 29 June 1971, J. Belkin and T. Rogers (RDO 57), 1 F [UCLA]. Santo Domingo, A. Busck, 6 F [USNM]. Santo Domingo, Calle Caonaba, 27 m, 25 July 1971, T. Rogers and E. Drake (RDO 157, 1 F [UCLA]. Santo Domingo, La Venta, 50 m, 6 Aug 1971, T. Rogers (RDO 207), 22 F [UCLA]. Santo Domingo, Finca Engombe, 2 m, 22 June 1971, J. Belkin, E. Drake and T. Rogers (RDO 29), 1 lpM (21), 1 lpF (20), 1 pF (100), 2 P, 10 L [UCLA]; same locality, 2 Aug 1971, E. Drake and T. Rogers (RDO 196), 1 M [UCLA]; same locality, 27 Aug 1971, T. Rogers (RDO 265), 3 lpM (10,11,13), 1 pM (102), 1 lp (12), 1 P, 2 l, 1 L, E [UCLA]; same locality and collector, 28 Aug 1971, (RDO 266), 3 F [UCLA]; same data (RDO 267), 8 lpM (20,22,25,28,31,33,34,36), 7 lpF (23,24,29,32,35,37,39), 1 lp (30), 1 lP (21), 5 M, 16 F, 13 L [UCLA]; same data (RDO 268), 1 lpF (48), 2 M, 2 F, 8 P, 2 p, 1 L [UCLA]; same data (RDO 269), 1 lpM (10), 1 lpF (11) [UCLA]; same locality and collector, 29 Aug 1971 (RDO 271), 1 lpF (21), 1 lp (20) [UCLA]; same data (RDO 272), 1 pF (108), 3 M, 5 F [UCLA]; same data (RDO 273), 6 F [UCLA]; same locality and collector, 30 Aug 1971 (RDO 278), 1 lpM (10), 1 lpF (11), 1 pF (100), 6 F, 3 L, E [UCLA]. **Duarte:** San Francisco de Macoris, 185 m, 22 July 1968, D. Watson (RDO 20), 4 F [UCLA]. **El Seibo:** Sabana de la Mar, 8 m, 30 June 1971, J. Belkin and T. Rogers (RDO 59), 3 F [UCLA]. La Vega, 75 m, 25 July 1968, D. Watson (RDO 24), 3 F [UCLA]. **Peravia:** San Jose de Ocoa, Los Anones, 960 m, 23 July 1968, D. Watson (RDO 22), 1 F [UCLA]. **Samana:** Santa Barbara de Samana, 2 m, 27 June 1971, J. Belkin and T. Rogers (RDO 49), 1 M, 6 F, 7 p [UCLA]. **San Cristobal:** San Cristobal, La Toma, 120 m, 23 July 1968, D. Watson (RDO 23), 2 lpM (20,21), 1 lp (22), 1 L [UCLA]. **Valverde:** Mao, 400 m, 14 Aug 1971, T. Rogers and J. Gomes (RDO 223), 5 F [UCLA].

ECUADOR. **Guayas:** Guayaquil, 5 Feb 1966, J. Belkin et al. (ECU 100), 7 lpM (11-14,20,23,25), 8 lpF (15-19,21,22,24), 1 pM (102), 1 p, 2 l, 8 L [UCLA]; same data (ECU 101), 20 F [UCLA]; same data (ECU 102), 1 lpM (20), 3 pF (100,101,103), 24 L [UCLA]. Guayaquil, 9 Feb 1966, J. Belkin and E. Gerberg (ECU 130), 92 F [UCLA]. Guayaquil, 22 May 1974, D. Pletsch (ECU 187), 3 F [UCLA]; same data (ECU 188), 2 F [UCLA]; same data (ECU 188A), 3 F [UCLA]; same data (ECU 188B), 1 F [UCLA]. Guayaquil, F. Campos R., 1 F (*camposanus* lectotype), 9 M, 5 F [USNM, BM]. Guayaquil, Mar 1940 (KO 202A-25), 12 F [UCLA]. Guayaquil (km 12 on rt 3), 11 Feb 1966, W. Hjort and D. Schroeder (ECU 144), 16 F [UCLA]. Guayaquil (km 10 on rt 3), 12 Feb 1966, E. Gerberg (ECU 162), 1 F [UCLA]; same locality, 15 Feb 1966, J. Belkin and E. Gerberg (ECU 168), 1 lpM (22), 1 lpF (21), 2 pM (103,106), 2 pF (104,105), 1 lp (20), 1 l [UCLA]; same data (ECU 169), 2 pM (85,113), 1 pF (81), 2 M, 1 F, 3 p, 3 L [UCLA]; same data (ECU 170), 3 F [UCLA]. Pascuales, 5 Feb 1966, W. Hjort and E. Gerberg (ECU 108), 9 F [UCLA]. Samborondon, 10 Feb 1966, J. Belkin (ECU 138), 69 M, 89 F [UCLA]. **Los Rios:** Babahoyo, Apr 1938, F. Campos (KO H-11-7), 8 F [UCLA]. **Manabi:** Manta, 14 Mar 1972 (ECU 184), 2 F [UCLA]. **Locality unspecified:** 1938, H. Hanson (ECUK 67), 5 F [UCLA].

EL SALVADOR. **La Union:** Canton El Cipres, 24 June 1966, J. Austin (SAL 45), 6 F [USNM]. **San Miguel:** Laguna el Jocotal, 20 km E Usulután, 21 Sept 1965, J. Austin (SAL 11), 1 F [USLA]; same locality and collector, 5 May 1966 (SAL 41), 4 F [UCLA]; same locality and collector, 24 May 1966 (SAL 43), 1 F [UCLA]. **San Salvador:** San Salvador, 14 June 1958, L. Bottimer, 2 F [USNM]. **Locality unspecified:** 2 F [USNM].

FRENCH GUIANA. **Guyane:** Cabassou, 26 Nov 1968, J. Clastrier (FGC 3875), 1 F [UCLA]; same locality, 31 Jan 1965, T. Aitken, R. Martinez and A. Guerra (FG 15), 1 M [UCLA]; same locality and collectors, 3 Feb 1965 (FG 43), 2 F [UCLA]; same data (FG 45), 1 F [UCLA]. Montjoly (9 km E Cayenne), 8 Feb 1965, T. Aitken and R. Martinez (FG 69), 1 M [UCLA].

GUATEMALA. **Escuintla:** Puente El Carrizo (nr. Iztapa), 10 July 1964, P. Cowsill (GUA 34),



28 F [UCLA]. **Izabal:** Bananera, 26 June 1964, P. Cowsill (GUA 4), 2 F [UCLA]. Bananera, 11 Aug 1964, T. Zavortink (GUA 114), 1 F [UCLA]. Bananera (13 km W), 4 Aug 1964, T. and J. Zavortink (GUA 95), 3 L [UCLA]. Mojaca Village (nr. Morales), 28 June 1964, J. Zavortink and P. Cowsill (GUA 12), 1 F [UCLA]. Navajo (betw. Morales and Puerto Barrios), 27 June 1964, T. and J. Zavortink and P. Cowsill (GUA 7A), 1 F [UCLA]. **Peten:** La Libertad, Apr 1942, (KO 50-8), 2 F [UCLA]. San Juan Acul, Apr 1942, 2 F [USNM].

**GUYANA.** **Berbice:** Berbice, Jan 1908, J. Aiken, 2 F [USNM]. Corentyne R., Village 116, 12 Oct 1962, T. Aitken [UCLA]. New Amsterdam, Oct 1966, M. Giglioli (GUY 11), 5 M, 5 F [UCLA]; same locality and collector, May, June 1967 (GUY 16), 49 F [UCLA]; same locality, E. Rowland, 2 F [BM]. Ptn. Blairmont, Nov 1920, G. Bodkin, 1 F [BM]. **Demerara:** Georgetown, 2 May 1944, C. Giglioli, 3 M, 3 F [USNM]. Hyde Park, 1 Aug 1941, L. Rozeboom (BGR 5), 1 F [UCLA]. **Locality unknown:** Dr. Low, 1 F [BM].

**HAITI.** **Nord:** Plaine du Nord, 16 Jan 1930 (HAR 16), 1 F [UCLA]. **Nord-Ouest:** Port de Paix, 8 Oct 1970, J. Porter (HAT 117), 1 F [UCLA]. **Ouest:** Bord de Mer Royale, 3 July 1968, D. Watson (HAT 10), 1 F [UCLA]. Petit Goave, 18 Oct 1924 (HAR 1), 4 M [UCLA]. Port-au-Prince, Oct 1929, Cook (HAC 2), 1 F [UCLA]. Port-au-Prince (Cite Simone Duvalier), 9-10 Oct 1970, M. Solis (HAT 133), 2 F [UCLA]. **Sud:** Les Cayes, 600 m, 8 July 1968, D. Watson (HAT 14), 2 F [UCLA]. **Locality unspecified:** 2 July 1931, Cook (HAC 9), 2 F [UCLA]; 29 Oct 1929 (HAR 8), 2 M, 1 F [UCLA]; (HAR 43), 1 F [UCLA]; (HAC 22), 6 F [UCLA]; (HAC 23), 2 F [UCLA].

**HONDURAS.** **Atlantida:** Lancetilla, 9 Feb 1972, K. and D. Schroeder (HON 121), 1 F [UCLA]. Tela, 30 Oct 1940, W. Komp, 1 M, 1 F [USNM]. Tela (2.5 km NW), 1.5 m, 9 Feb 1972, D. Schroeder (HON 118), 1 lpM (10) [UCLA]. **Colon:** Corocito, 3 Apr 1924, 1 F [UCLA]. Puerto Castillo, 24 Nov-21 Dec 1942, J. Duncan, 10 M, 9 F [USNM, UCLA]; same locality and collector, 24 Dec 1942 (KO 204A-9), 10 F [UCLA]; same locality, K. Maxwell, 1 F [USNM]. La Lima, 5 Aug 1964, P. Cowsill (HON 1), 1 F [UCLA]. San Pedro Sula (21 km N), 11 Aug 1967, A. Adames (HON 65), 10 F [UCLA].

**JAMAICA.** **Clarendon:** Goshen, 10 Sept 1965, J. Belkin (JA 353), 1 F [UCLA]. Parnassus, 10 m, 28 July 1967, W. Page (JA 863), 5 lpM (21-24,26), 4 lpF (20,25,27,28), 1 pM (37), 3 M, 1 P, 1 l, 11 L [UCLA]. Yorks Pen, 50 m, 6 Sept 1966, D. Watson (JA 604), 1 lpF (10) [UCLA]. **Kingston and St. Andrew:** Kingston, from M. Grabham, 1 F [USNM]. Rio Cubre Dam, M. Grabham, 1 F [USNM]. **St. Andrew:** Ferry, 15 m, 9 Aug 1967, J. Belkin, W. Page (JA 896), 4 lpF (13,23,24,28), 3 pM (102,104,111), 5 pF (96,101,103,109), 1 lp (22), 33 M, 51 F, 1 p, 10 L [UCLA]; same locality, 17 Sept 1967, W. Page (JA 799), 1 F, 1 P [UCLA]; same locality, 18 Sept 1967, W. Page (JA 796), 1 lpF (14), 2 pM (91,102), 1 pF (112), 9 L [UCLA]; same locality (JA 768), 2 L [UCLA]; same locality (JA 890), 1 F [UCLA]. **St. Ann:** Delight, 200 m, 25 Aug 1967, J. Belkin, W. Page (JA 757), 1 lpF (45), 1 pM (112) [UCLA]. **St. Catherine:** Bog Walk, 90 m, 4 Aug 1968, R. Hochman (JA 913), 1 F, E [UCLA]. Caymanas, 26 Nov 1965, W. Page (JA 404), 5 F [UCLA]. Central Village, 20 m, 29 Aug 1967, W. Page (JA 759), 1 lpF (20) [UCLA]. Spanish Town, 6 Feb 1964, H. Tucker (JA 37), 1 lpF (14) [UCLA]. **St. Thomas:** Golden Grove (nr. Morant Bay), 1 Feb 1965 (JA 197), 1 L [UCLA]. Grants Pen, 150 m, 30 Oct 1966, G. Berlin and D. Watson (JA 649), 4 F [UCLA]. **Locality unspecified:** F. Cundall and M. Grabham, 1 M, 4 F [BM].

**MEXICO.** **Campeche:** Hopelchen (12 km W on hwy 180), 80 m, 4 Aug 1970, K. and D. Schroeder (MEX 600), 1 pF (100) [UCLA]. Lerma, 6 m, 21 July 1970, K. and D. Schroeder (MEX 592), 1 F [UCLA]; same locality, 5 Aug 1970, D. Schroeder (MEX 605), 1 F [UCLA]; same data (MEX 607), 9 F [UCLA]. **Nuevo Leon:** Monterey, 500 m, 11 July 1965, R. Schick and D. Schroeder (MEX 188), 1 F [UCLA]. **Tabasco:** Cardenas, 30 m, 15 July 1970, K. and D. Schroeder (MEX 564), 5 F [UCLA]. Comalcalco (12 km N), 37 m, 12 July 1970, K. and D. Schroeder (MEX 544), 1 F [UCLA]. Comalcalco (7.5 km N), 38 m, 12 July 1970, K. and D. Schroeder (MEX 552), 10 F [UCLA]. Frontera, 18 Feb, C. Townsend, 1 F [USNM]. Tenosique, 17 July 1970, K. and D. Schroeder (MEX 569), 1 F [UCLA]. **Tamaulipas:** Ciudad Mante, 120 m, 14 July 1965, R. Schick and D. Schroeder (MEX 198), 33 F [UCLA]. **Veracruz:** Cerro Guzman (? Guzmantla), 9 July 1970, K. and D. Schroeder (MEX 535), 2 F [UCLA]. Cordoba,



F. Knab, 2 F [USNM]. Cordoba, 1000 m, 6 July 1970, D. and K. Schroeder (MEX 527), 1 F [UCLA]. Cuitlahuac (11 km E), 410 m, 15 July 1965, E. Fisher and D. Verity (MEX 35), 6 F [UCLA]. Santa Lucrecia (Jesus Carranza), F. Knab, 5 F [USNM]. Veracruz, Crawford, 2 F [USNM].

NICARAGUA. **Locality unspecified:** 6 Apr 1943, T. Aitken, 2 F [UCLA].

PARAGUAY. **Boqueron:** Gen. Eugenio A. Garay Colony (Fortin Coronel Eugenio A. Garay), June 1964, W. Murdock, 4 F [UTAH]. **La Cordillera:** San Bernardino, Fiebrig, 2 M, 2 F [USNM]. **Locality unknown:** [?] Eng. Mission, Choco, 2 June 1927, L. Rozeboom, 1 F [UCLA].

PERU. **Amazonas:** Bagua, 10-15 Jan 1954, W. Ebeling, 19 F [UCLA]. **Ica:** Pisco, Aug 1925, T. Cockerell, 1 M [USNM]. **La Libertad:** San Idelfonso, 50 m, 25 Feb 1973, F. Morales-Ayala (PER 109), 23 F [UCLA]; same data (PER 111), 8 F [UCLA]. **Lima:** Canete, Feb, Mar 1941, E. Hambleton, 2 F [USNM]. Lima, spring 1943, E. Hopkins, 2 M [USNM]. **Piura:** Piura, 22 Dec 1968, M. Nelson (PER 10), 1 pF (10), [UCLA]; same locality and collector, 3 Jan 1969 (PER 23), 5 lpM (10,11,16-18), 4 lpF (12-15), 2 pM (100,101), 1 IP (19), 4 P, 1 p, 3 l, 1 L [UCLA]. **Sullana,** 3 Jan 1969, M. Nelson (PER 17), 8 F [UCLA]. **Talara,** Rio Parinas, 12 Dec 1943, 1 F [USNM]. **Talara,** Mar 1942, J. Ruddy (KO 105-20), 1 F [UCLA]. **Tumbes:** Tumbes, 30 Dec 1968, M. Nelson (PER 14), 10 F [UCLA]; same data (PER 16), 1 F [UCLA].

SURINAM. **Suriname:** Lelydorp, 17-21 Apr 1964 (SUR 78), 1 F [UCLA]; same locality, 21-23 Apr 1964 (SUR 79), 4 F [UCLA]; same locality, 26-29 May 1964 (SUR 81), 4 F [UCLA]; same locality, 29 May-2 June 1964 (SUR 113), 3 M, 7 F [UCLA]. **Zanderij,** 26-30 June 1964 (SUR 82), 2 F [UCLA]; same locality, 1-5 July 1964 (SUR 83), 3 F [UCLA]; same locality, 6-10 July 1964 (SUR 84), 3 F [UCLA]; same locality, 14-17 July 1964 (SUR 85), 7 F [UCLA]; same locality, 21-24 July 1964 (SUR 87), 2 F [UCLA]; same locality, 21-26 June 1964 (SUR 88), 5 F [UCLA]; same locality, 27-30 July 1964 (SUR 90), 2 F [UCLA]; same locality, 31 July-3 Aug 1964 (SUR 91), 2 F [UCLA]; same locality, 27-30 Aug 1964 (SUR 99), 1 F [UCLA]; same locality, 11-14 June 1964 (SUR 114), 3 F [UCLA]; same locality, 14-17 June 1964 (SUR 115), 1 F [UCLA]; same locality, 17-22 June 1964, D. Geijskes (SUR 116), 8 F [UCLA]. **Locality unspecified:** 12 Feb 1908, J. Aiken, 2 p [USNM].

TRINIDAD AND TOBAGO. **TOBAGO. St. Andrew:** Bacolet, 3 Aug 1963, T. Aitken, 1 F [UCLA]. Scarborough, 60 m, 15 Nov 1965, T. Aitken, R. Martinez, A. Guerra (TOB 2), 1 lpM (20) [UCLA]; same locality and collectors, 75 m (TOB 4), 1 lpF (50) [UCLA]; same data (TOB 6), 1 IP (60) [UCLA]; same data (TOB 7), 1 L [UCLA]; same data (TOB 11), 1 F [UCLA]; same locality, 20 Nov 1965, R. Martinez and A. Guerra (TOB 65), 1 F [UCLA]; same data (TOB 66), 1 F [UCLA]; same data (TOB 67), 4 F [UCLA]. **St. Patrick:** Buccoo, 12 Jan 1966, R. Martinez and A. Guerra (TOB 158), 1 F [UCLA]. **Canaan,** 19 Nov 1965, T. Aitken, R. Martinez, A. Guerra (TOB 57), 1 L [UCLA]; same data (TOB 59), 4 F [UCLA]. **Golden Grove Road,** 30 Nov 1965, R. Martinez, A. Guerra (TOB 145), 1 IP (10) [UCLA]. **St. Paul:** Roxborough, 16 Nov 1965, T. Aitken, R. Martinez, A. Guerra (TOB 28), 1 F [UCLA]; same locality and collectors, 17 Nov 1965 (TOB 50), 1 M, 4 F [UCLA]; same locality, 30 Dec 1965, R. Martinez, A. Guerra (TOB 153), 2 F [UCLA]. **Locality unspecified:** (TOB 161), 1 F [UCLA]. **TRINIDAD. Caroni:** Todd's Road, 17 June 1941, Hopkins (TRR 8), 1 M, 1 F [UCLA]. **St. Andrew:** Cumuto, 11 June 1941, Hopkins (TRR 5), 4 F [UCLA]. Cumuto, 11 July 1941, Hopkins (TRR 21), 3 F [UCLA]. Cumuto, 21 July 1941, Hopkins (TRR 28), 4 F [UCLA]. Cumuto, 5 Aug 1941, Hopkins (TRR 40), 5 F [UCLA]. Cumuto, 14 Aug 1941, Hopkins (TRR 47B), 1 F [UCLA]. Cumuto, 5 Aug 1941 (TRR 62), 1 F [UCLA]. **St. Andrew:** Mt. Harris, 75 m, 16 July 1964, F. Powdher (TR 573), 5 F [UCLA]. Mt. Harris, 23-31 July 1924, C. Withycombe, 5 F [BM]. **Nestor Village,** 14 June 1964, A. Guerra (TR 484), 1 F [UCLA]. **St. Georges:** Monos I., 27 July 1931, E. de Verteuil, 2 M [BM]. **Port of Spain,** 2 Sept 1929, W. Hoffman (LAR 54), 2 M [UCLA]; same data (LAR 55), 9 M, 9 F [UCLA]. **St. Patrick:** Cedros, 23 Aug-19 Sept 1920, J. Pawan, 4 F [BM]. Cedros, C. Hewlett, 1 M, 1 F [BM]. **Fyzabad,** 12 Jan 1924, S. Neave [BM]. **Victoria:** San Fernando, 1-2 Feb 1912, G. Marshall, 2 F [BM]. **Locality unspecified:** 3 Mar 1931, M. Beattie, 1 M, 1 F [BM]; A. Busck, 3 F [USNM]; F. Urich, 2 F [USNM].

UNITED STATES. **Texas:** Brownsville, 28 Aug 1916, M. High, 1 F [USNM]. Brownsville,



Oct 1932, A. Niven, 2 F [USNM]. Brownsville, 5 Jan 1940, 2 F [USNM]. Brownsville, R. Turner, 1 F [USNM]. Cameron Co., 19 Oct 1943, Pfeifer, 1 F [USNM]. Mission, 4 May 1924, R. Turner, 13 F [USNM]. Mission, 20 Sept 1944, C. Joyce, 2 L [USNM]. Rio Hondo, 11 June 1942, W. Reeves, B. Brookman and R. Eads, 1 M [USNM]. San Benito, 17 June 1942, W. Reeves, B. Brookman, R. Eads, 1 M [USNM]. Santa Maria, 30 Apr 1942, B. Brookman and W. Reeves, 1 M, 1 P, 3 L [UCLA, USNM].

VENEZUELA. **Aragua:** Cagua, 400 m, 12 Aug 1969, Valencia and Pulido (VZ 344), 15 F [UCLA]. Maracay, Dec 1967, Hansell and Vera (VZ 91), 1 lpM (10), 1 L [UCLA]. Maracay, 24 Aug 1926, M. Nunez Tovar, 5 F [USNM]. Maracay, 10 May 1927 (VZR 4), 2 F [UCLA]. Maracay, 25 July 1927 (VZR 18), 10 M, 4 F [UCLA]. Maracay, Aug 1928 (VZR 57), 1 M, 1 F [UCLA]. Maracay (VZR 247), 2 M [UCLA]. Maracay (VZR 249), 2 F [UCLA]. Ocumare de la Costa, 100 m, 12 July 1969, Pulido and Valencia (VZ 185), 2 F [UCLA]; same locality, 0 m, 15 Aug 1969, Pulido (VZ 352), 2 lpM (10,11), 3 pM (100-102), 2 P, 1 L, 2 L [UCLA]; same locality, 1927, M. Nunez Tovar, 1 F [USNM]; same locality, 5 July 1927 (VZR 14), 16 F [UCLA]. San Jacinto Mil. Res. (nr. Maracay), 27 Nov 1928 (VZR 98), 3 M [UCLA]; same locality, 19 Feb 1929 (VZR 150), 1 M, 1 F [UCLA]; same locality, 11 Mar 1929 (VZR 153), 2 M, 4 F [UCLA]; same locality, 13 Apr 1929 (VZR 168), 3 M [UCLA]; same locality, 3 July 1929 (VZR 212), 2 M [UCLA]. Turiamo, 14 Sept 1944, W. Komp (KO 202A-24), 7 F [UCLA]. Turmero, 400 m, 12 Aug 1969, Valencia and Pulido (VZ 336), 1 pM (100) [UCLA]; same data (VZ 345), 4 F [UCLA]. **Carabobo:** Lake Valencia, 29 Nov 1967, R. Hansell (VZ 62), 1 F [UCLA]; same locality and date, P. Rausch (VZ 66), 1 F [UCLA]. Puerto Cabello, 30 Nov 1967, P. Rausch, R. Hansell and Vera (VZ 75), 2 pM (101,103), 1 pF (100) [UCLA]. **Distrito Federal:** Juan Diaz, Dec 1927 (VZR 31), 4 F [UCLA]; same data (VZR 32), 1 F [UCLA]; same data (VZR 33), 2 F [UCLA]. **Miranda:** La Trinidad, Mar 1929 (VZR 162), 2 M [UCLA]. **Locality unspecified:** 10 Oct 1926, M. Nunez Tovar, 1 M [USNM].

#### Additional Records from the Literature

ARGENTINA. **La Pampa:** Planicie de la Loma Negra (Dyar, 1921:150).

BOLIVIA. **Beni:** Riberalta (Cerqueira, 1943:32).

BRAZIL. **Amapa:** Amapa; Macapa. **Amazonas:** Codajas; Manaus. **Goiás:** Pedro Afonso; Porto Nacional. **Mato Grosso:** Chapada do Guimaraes; Cuiaba (Cerqueira, 1961:145).

COLOMBIA. **Meta:** Restrepo (Komp, 1936:62).

### 17. *Aedes (O.) comitatus* Arnell, sp. n.

Figs. 4,32

TYPES. *Holotype* male with genitalia slide (740523-64), Bosque Ocoa, E of Villavicencio, Meta, Colombia, 23 May 1944, through W.H.W. Komp (KO 200-17) [USNM]. *Paratype:* 1 M with genitalia slide (740523-63), same locality as holotype, 16 July 1943, through W.H.W. Komp (KO 200-2) [UCLA].

FEMALE. Unknown.

MALE. Wing: 2.80 mm. Proboscis: 2.05 mm. Forefemur: 1.55 mm. Abdomen: about 2.45 mm. Generally similar to *scapularis*. Thoracic and abdominal scaling indistinct, specimens badly rubbed but with scattered white scales on anterior of scutum. **Head:** Proboscis short, about 1.35 of forefemur. Palpus about 1.10 of proboscis; segments 2 and 3 making up 0.66 of palpus, segments 4 and 5 relatively short, their combined length about 0.28 of palpus. Antenna about 0.90 of proboscis. **Legs:** Forefemur 1.20 of distance from top of thorax to apex of midcoxa. Anterior claw of foreleg and midleg considerably enlarged, with blunt submedian tooth and apparently acute basal tooth; posterior claw of midleg mod-



erately enlarged, apparently with acute basal tooth. **Wing:** Scales apparently all dark. **Abdomen:** Terga apparently entirely dark scaled dorsally and with basal white scale patches laterally. Sterna mostly white scaled.

**MALE GENITALIA** (fig. 32). **Segment IX:** Anterior middorsal emargination of tergum broad and shallow, caudal bridge connecting tergal lobes broader than distance between lobes; tergal lobes broader than high, with 4 or 5 setae. **Sidepiece:** Length about 3.5-4.0 times median width; tergal surface with setae relatively short and sparse, and cluster of 4-6 subapicotergal setae; sternomesal margin with 30-40 well developed setae concentrated at distal third of sidepiece; apical tergomesal lobe moderately developed; basal tergomesal lobe moderately developed, apparently conical, differentiated seta large, with about 10 undifferentiated setae and a single seta on ventral margin of setal cluster which is considerably larger than remainder of undifferentiated setae. **Claspette:** Stem uniformly narrow and broadly curved dorsad; filament slightly longer than stem, narrow at base, expanded near middle and tapered to very acute tip. **Clasper:** Slightly curved inward distally; spiniform length about 10 times the greatest width. **Phallosome:** Aedeagus ovate.

**PUPA, LARVA.** Unknown.

**SYSTEMATICS.** *Aedes comitatus* is known only in the male, and can be separated from all other species in the Scapularis Group by the following characters of the male genitalia: (1) the claspette filament has no retrorse process and (2) the basal tergomesal lobe of the sidepiece has a ventral seta which is smaller than the differentiated seta but considerably larger than the undifferentiated seta.

Although both specimens are rubbed, there are sufficient numbers of thoracic scales present to indicate the Scapularis Subgroup scutal scale pattern and slight indications of hindtibial white scales, although the hindtibial white scale streak is rarely prominent in males of the Scapularis Subgroup.

W. H. W. Komp (1936:62; 1956:38) mentions taking, in yellow fever surveys in the vicinity of Villavicencio, Colombia, adult specimens of *scapularis*, as well as larvae of *angustivittatus* that produced adults that "had the thorax suffused over with white...the...species thus much resembl(ing) *scapularis*." Scapularis Group specimens that I have been able to locate that may be attributable to Komp's collections in this part of Colombia include possibly 4 females of *euplocamus* collected in 1935, 2 males of *angustivittatus*, with typical *angustivittatus* scutal ornamentation, collected in 1935 and the 2 males of *comitatus*, collected in 1943 and 1944. It is impossible to know what species Komp had before him in his reference to "*scapularis*-like *angustivittatus*," *euplocamus*, *scapularis*, which, in view of its abundance in Colombia probably inhabits the Villavicencio area although I have seen no specimens from there, or possibly *comitatus*, which may agree with his cryptic description in the female.

**BIONOMICS.** Nothing is known of the bionomics of *comitatus*. The holotype was a "hand catch."

**DISTRIBUTION** (fig. 4). *Aedes comitatus* is known from a single locality near Villavicencio, Meta, Colombia. Material examined: 2 specimens; 2 males.

**COLOMBIA. Meta:** Type series, see above.

## CRINIFER SUBGROUP

**FEMALES.** **Head:** Occipital dorsolateral dark scale patch present or absent. Palpus 3 or 4 segmented. **Thorax:** Scutum with 3 narrow lines of light scales extend-



ing entire length of scutum, often joined into single, broad line; or, light scales on dark background in somewhat random pattern but suggesting 3 narrow longitudinal lines, 1 acrostichal and 1 dorsocentral; white scales along humeral margin, above paratergite, along supraalar margin, and surrounding prescutellar bare space. Acrostichal, anterior dorsocentral, and posterior fossal setae well developed. Legs: Knee spots of white scales present posteriorly on apices of femora. Tibiae and basal tarsal segments of foreleg and midleg with light streak posteriorly; hindtibia and hindtarsus entirely dark. Claws of hindleg with submedian tooth. Wing: Scales entirely dark. Abdomen: Terga entirely dark scaled dorsally.

MALES. Thorax: Scutal scale pattern generally similar to female although light scales more extensive. Legs: Anterior claw of foreleg with submedian tooth and acute basal tooth. Abdomen: Sterna usually mostly dark scaled.

DISCUSSION. The Crinifer Subgroup is defined by the female scutal scale pattern of narrow acrostichal and dorsocentral lines of light scales extending the length of the scutum or light and dark scales in a more or less random pattern that suggests acrostichal and dorsocentral light lines, and by the male genitalia (see species accounts below).

The subgroup consists of 2 species, *crinifer* and *synchytus*, with a distribution throughout southeastern Brazil, Uruguay, northern Argentina and probably eastern Paraguay (see fig. 1). *Aedes crinifer* appears to be relatively common in this area; however, *synchytus* is known only from the type locality.

### 18. *Aedes (O.) crinifer* (Theobald)

Figs. 2,38,39,40

- 1903. *Culex crinifer* Theobald, 1903a:209-210. TYPE: *Lectotype* female, Sao Paulo, Sao Paulo, Brazil, A. Lutz. [BM; selection of Belkin, 1968:4].
- 1910. *Culex lynchii* Brethes, 1910:470-471. TYPE: *Lectotype* female, Buenos Aires, Argentina, 19 Jan 1903, J. Brethes [BA, selection of O. H. Casal in Belkin, Schick and Heinemann, 1968:13]. Synonymy with *crinifer* by Edwards (1932:142).
- 1917. *Culex tapinops* Brethes, 1917:227-229. TYPE: *Lectotype* male, San Isidro, Buenos Aires, Argentina, 2 Feb 1917, J. Brethes [BA, selection of O. H. Casal in Belkin, Schick and Heinemann, 1968:13-14]. Synonymy with *lynchii* by Dyar (1922a:56).
- 1928. *Aedes (Ochlerotatus) iguazu* Shannon and Del Ponte; in Dyar, 1928:168-169. TYPES: *Syntypes*, male, female, Misiones, Argentina [LU]. Synonymy with *crinifer* by Edwards (1932:142).

*Aedes (Ochlerotatus) crinifer* of Dyar (1922a:57; 1928:164-165); Bonne and Bonne-Wepster (1925:391); Shannon and Del Ponte (1928:123); Shannon (1931b:149); Edwards (1932:142) in part); Antunes and Lane (1934:35-37); Lane (1939:108, in part; 1951:335; 1953:668-669, in part); Cerqueira (1943:31; 1961:143-144); Duret and Barreto (1956:90); Rachou, Lima et al. (1958:417); Stone, Knight and Starcke (1959:143, in part); García and Ronderos (1963:29); Prosen, Carcavallo and Martinez (1964:99); Forattini (1965:358, in part); Belkin, Heinemann and Page (1970:164); Xavier and Mattos (1970:445).

*Aedes (Heteronychia) crinifer* of Dyar (1920:105).

*Aedes crinifer* of Prado (1931:201); Davis (1944:225); Del Ponte, Castro and Garcia (1951:236); Mattos and Xavier (1965:277).

*Culex crinifer* of Lutz (1904a:8; 1904b:4); Theobald (1905:29; 1907:pl.13,14; 1910:361); Surcouf and Gonzalez-Rincones (1911:181); Lutz, de Sousa Araujo and da Fonseca Filho (1919:87).

*Aedes (Ochlerotatus) lynchii* of Dyar (1922a:56-57; 1928:165); Shannon and Del Ponte (1928:122).



*Aedes (Ochlerotatus) iguazu* of Lane (1939:110).

*Aedes iguazu* of Del Ponte, Castro and Garcia (1951:236).

*Aedes (Heteronychia) dolosa* of Lynch (1891:156; in part); Dyar (1920:105).

*Culicelsa confirmatus* of Dyar (1905c:186).

**FEMALE** (figs. 38,39). Wing: 4.00 mm. Proboscis: 2.40 mm. Forefemur: 1.90 mm. Abdomen: 2.80 mm. **Head:** Occipital dorsolateral dark scale patch usually present. Palpus 4 segmented. **Thorax:** Scutum with tan to white scales in narrow acrostichal line and narrow dorsocentral line extending entire length of scutum, these lines separated by brown scales which are often reduced in extent, resulting in a broad median stripe of light scales; brown scales laterad of dorsocentral line.

**MALE** (figs. 38,39). Wing: 4.25 mm. Proboscis: 3.00 mm. Forefemur: 1.85 mm. Abdomen: 4.30 mm. **Thorax:** Scutum with broad median stripe of yellow to tan scales extending entire length of scutum between dorsocentral lines.

**MALE GENITALIA** (fig. 39). **Segment IX:** Anterior middorsal emargination of tergum broad and shallow, caudal bridge connecting tergal lobes broad; tergal lobes usually broader than high, with 3-8 setae. **Sidepiece:** Length about 4.0-4.5 times median width; sternomesal margin with 50-60 long setae, most dense at level of base of apical tergomesal lobe; apical tergomesal lobe very well developed; basal tergomesal lobe well developed, triangular with anterior and posterior sides subequal in length, setae arising from near posterior side, with about 20-30 undifferentiated setae, a row of usually 6-8 projecting distad from posterior side of lobe. **Claspette:** Stem long, length about 10 times median width, uniformly narrow, broadly curved dorsad on basal two-thirds, distal third recurved ventrad; filament uniformly narrow on basal half, angled dorsad near basal fourth, abruptly expanded near middle with strong retrorse process and usually several elongate spicules basad of retrorse process and tapered abruptly to recurved tip. **Clasper:** Narrow, only slightly broadened before middle; spiniform length about 10-13 times its greatest width. **Phallosome:** Aedeagus ovate.

**PUPA** (fig. 39). Abdomen: 3.00 mm. Trumpet: 0.45 mm. Paddle: 0.80 mm. **Cephalothorax:** Weakly pigmented, very slightly darker dorsally. **Abdomen:** Weakly pigmented, only slightly darker anteriorly. Seta 1-II usually 4-6(4-8) branched. Seta 5-IV-VI subequal in length to length of succeeding tergum, double on all segments.

**LARVA** (fig. 40). Head: 0.75 mm. Siphon: 0.80 mm. Anal Saddle: 0.35 mm. **Head:** Seta 5-C triple (3-5b). Seta 6-C triple. Seta 7-C 8-10 (8-11) branched. **Thorax:** Spicules of integument numerous and long, length about 5-8 times basal diameter. Seta 3-P triple (3-5b). Seta 1-M 4(3-5) branched. **Abdomen:** Seta 13-III strongly developed, single; seta 13-IV,V usually double. **Segment VIII:** Comb scales moderate in size, with well developed median spinule, about 16-20(9-25) in number, in irregular double to triple row. **Siphon:** Index about 2.45-2.60. Pecten with teeth evenly spaced, extending slightly beyond middle of siphon. Seta 1-S inserted distad of pecten. 2 or 3 pairs of accessory dorsolateral setal tufts (2a-S) present, each usually 4(3-5) branched, and subequal to 1-S. **Anal Segment:** Ventral brush (4-X) with 8 pairs of setal tufts.

**SYSTEMATICS.** *Aedes crinifer* can be separated from the other species of the Scapularis Group by the following characters: in the female the scutum has tan to white scales in a narrow acrostichal and dorsocentral line extending the entire length of the scutum, these lines usually separated by dark brown scales, but occasionally



the light lines merge to form a broad median light stripe bordered laterally by dark brown scales; in the male genitalia, indistinguishable from *synchytus*, (1) the claspette stem is narrow and curved dorsad on the basal two-thirds and recurved ventrad on the distal third, (2) the claspette filament is angled dorsad near the basal fourth and is very broad just distad of the retrorse process, and (3) the apical tergomesal lobe is very well developed; in the larva the siphon has 2 or 3 pairs of accessory dorsolateral setae (2a-S) subequal in development to seta 1-S.

The presence of accessory dorsolateral setae on the siphon of *crinifer* is unique in the Scapularis Group and rare except in the Culicini and Sabethini. In New World Aedini these setae are known in only 2 other species, well developed in *Aedes (O.) trichurus* (Dyar), which is widespread in southern Canada and the northern United States, and poorly developed in *Aedes (O.) bicristatus* Thurman and Winkler, a species known only from northern California. Although the accessory dorsolateral setal tufts of *crinifer* are subequal in development to the siphon tuft (1-S), I consider them to be a multiplication on seta 2-S rather than of 1-S because of their location.

Brethes (1910:470-471) described *lynchii* from females previously described by Lynch Arribalzaga (1891:156) as *Heteronycha dolosa*, Lynch apparently describing his species from male *Culex* and female *Aedes*. Brethes (1916:212) later described the supposed male of *lynchii*, in reality a *Culex (brethesi)* Dyar, 1919, and then did not recognize the true male of *lynchii* and described it as *tapinops* (1917:227-229). Dyar (1922a:56) included *tapinops* in the synonymy of *lynchii*, and Edwards (1932:142) synonymized *lynchii* under *crinifer*.

Apparently from a large series of adults collected at Iguazu Falls, Argentina by R. C. and E. M. Shannon during the week of 4-10 October 1927, Shannon and Del Ponte described *iguazu* (Dyar, 1928:168-169), and stated that types were deposited in the U.S. National Museum. Belkin, Schick and Heinemann (1968:14) reported that 3 female syntypes of *iguazu*, without type labels but with the above collection data, were present in the USNM collection. I was unable to locate those specimens or any other material that could be identified as part of the syntype series of *iguazu*. However, 2 males and 15 females of *crinifer*, with which the Shannon and DelPonte description of *iguazu* agrees in every respect, with the above mentioned Shannon and Shannon collection data, were in the USNM collection. I am therefore considering *iguazu* as a synonym of *crinifer*.

**BIONOMICS.** Immature stages of *crinifer* have been collected in temporary ground pools in all documented cases except 1 report by Davis (1944) who collected *crinifer* larvae in cut bamboo at Teresopolis, Brazil, at a time when all ground pools were dry. This species was collected near Itapetininga, Brazil from a small, temporary, grassy ground pool associated with larvae of *Anopheles (N.) evansae*, *Culex (Mel.) pilosus*, *Culex (C.)* sp near *coronator* and *Aedes (O.) dupreei*. Causey and Kumm (1948) recaptured marked adults of *crinifer* 2.3 km from the release site in a forested area of Brazil.

**DISTRIBUTION.** *Aedes crinifer* is found throughout southeastern Brazil, Uruguay, northeastern Argentina and undoubtedly Paraguay. Although *crinifer* has been reported from Panama, Colombia (Komp, 1936:62), Venezuela, French Guiana (Fauran, 1961:26), Ecuador, Peru, Bolivia (Cerqueira, 1943:31; Prosen, Carcavallo et al. (1964:99) and northern Brazil (Cerqueira, 1961:143-144), these records are undoubtedly misidentifications or misinterpretations of this species. *A. crinifer* appears to be restricted to the Parana River system and adjacent coastal drainage of southeastern Brazil and Uruguay. Material examined: 134 specimens; 26 males, 84



females, 13 pupae, 11 larvae; 12 individual rearings (4 larval, 4 pupal, 4 incomplete).

**ARGENTINA.** **Buenos Aires:** Buenos Aires, J. Brethes, 4 F [USNM]. Buenos Aires, 1920, J. Petrocchi, 7 F, 1 L, E [USNM]. Campana, 24 Mar 1966, Garcia and Casal (240), 2 M [INM]; same locality and collectors, 24 July 1968 (648), 2 pM (104,106), 2 pF (103,107), 1 p [INM]. Rio Santiago, 18 Nov 1915, J. Petrocchi, 1 F [USNM]. **Corrientes:** Paso de los Libres, 23, 25 July 1970, Bejarano (GA 1100,1106,1107,1112), 6 M, 2 F [INM]; same locality and collector, 28 July 1971 (GA 1132,1133,1135), 2 M, 1 F [INM]. **Entre Rios:** Concepcion del Uruguay, 3 F [USNM]. **Misiones:** Iguazu, 4-10 Oct 1927, R. and E. Shannon, 2 M, 15 F [USNM]. San Ignacio, 1911, E. Wagner, 3 F [USNM]. **Province unknown:** Miguel Garcia, 10 Dec 1915, J. Petrocchi, 1 F [USNM]. **Locality unspecified:** J. Petrocchi, 1 M [USNM].

**BRAZIL.** **Mato Grosso:** Maracaju, June 1937, 19 F [USNM]. **Parana:** Cambara, Oct 1936, 1 M [USNM]. Curitiba, Dec 1938, 1 M [UCLA]. **Rio de Janeiro:** Mangaratiba, Nov 1938, 5 F [USNM, UCLA]. Teresopolis, May 1938, R. Shannon, 4 F [USNM]. **Santa Catarina:** Nova Teutonia, 27 July-26 Sept 1938, F. Plaumann, 2 M, 2 F [BM]. **Sao Paulo:** Guaratuba River, 30 Sept 1972, H. Xavier, 1 F [UCLA]. Itapetininga, 30 Nov 1973, H. Xavier, 1 F [UCLA]. Itapetininga (28 km W), 5 Feb 1975, T. Rogers and K. Linthicum (BRA 167), 2 lpM (21,24), 2 lpF (23,70), 3 lP (20,22,25), 1 P, 1 l, 1 L [UCLA]. Juquia, Nov 1938, J. Lane [USNM]. Sao Paulo, A. Lutz, 1 F (*crinifer* lectotype) [BM]. Sao Paulo, 6 Aug 1903, 1 M [USNM]. Sao Paulo, J. Lane and P. Antunes, 1 M, 2 F [BM, UCLA]. **Locality unspecified:** A. Lutz, 1 F [BM].

**URUGUAY.** **Rivera:** Rivera, 3 Sept 1944, 1 M [USNM]. [?] Rocha, San Carlos, 11 Mar 1945, Parker and Hackett, 2 F [USNM]. **Treinta y Tres:** Treinta y Tres, 7 Mar 1945, Parker and Hackett, 1 F [USNM].

**LOCALITY UNSPECIFIED.** 1 M, 1 F [BM].

#### Additional Records from the Literature

**BRAZIL.** **Goiás:** Anapolis (Mattos and Xavier, 1965:277). **Mato Grosso:** Cuiaba (Cerqueira, 1961:144). Dourados (Xavier and Mattos, 1970:445). **Minas Gerais:** Passos (Causey and Kumm, 1948:469).

### 19. *Aedes (O.) synchytus* Arnell, sp. n.

Figs. 4,41

**TYPES.** *Holotype* female, Cataratas del Iguazu, Misiones, Argentina, 4-10 Oct 1927, R. C. and E. M. Shannon [USNM]. *Allotype* male with genitalia slide (2354), same data as holotype [USNM]. *Paratypes:* 41 females, same data as holotype [UCLA, USNM, BM, ISNM, FH].

**FEMALE** (fig. 41). Wing: 4.00 mm. Proboscis: 2.60 mm. Forefemur: 2.05 mm. Abdomen: 2.40 mm. **Head:** Occipital dorsolateral dark scale patch reduced or absent. Palpus 3 segmented. **Thorax:** Scutum with white to yellow scales on background of dark brown scales in somewhat random pattern but usually suggesting 3 narrow longitudinal lines, 1 acrostichal and 1 dorsocentral; white scales present along humeral, antealar, and supraalar margins and surrounding prescutellar bare space; light scales often concentrated along prescutal suture.

**MALE** (fig. 41). Wing: 3.40 mm. Proboscis: 2.45 mm. **Thorax:** Scutum with brown and white scales mixed in apparent random pattern.

**MALE GENITALIA** (fig. 41). Apparently indistinguishable from *crinifer*.

**PUPA, LARVA.** Unknown.

**SYSTEMATICS.** *Aedes synchytus* is known only in the adult and can be separated from the other species of the Scapularis Group by the following characters: in the female the scutal scales are of 2 contrasting colors, white to yellow and dark brown, and arranged in a somewhat random pattern that often suggests 3 light longitudinal lines, acrostichal and dorsocentral, on a dark background; in the male geni-



*tal*ia, indistinguishable from *crinifer*, (1) the claspette stem is narrow and curved dorsad on the basal two-thirds and recurved ventrad on the distal third, (2) the claspette filament is angled dorsad near the basal fourth and is very broad just distad of the retrorse process, and (3) the apical tergomesal lobe is very well developed.

The type series of *synchytus* was found in the undetermined excess collection at the U.S. National Museum, and is part of a large series of adults collected by Shannon and Shannon at Iguazu Falls, Argentina in October 1927. It is closely allied to *crinifer*, as demonstrated by the male genitalia and the general facies of the adults; however, the scutal scale pattern is unlike any other species of the Scapularis Group.

**BIONOMICS.** Nothing is known of the bionomics of *synchytus*. The type series consists entirely of adults collected during a 1 week period. Present in the same collection were specimens of *crinifer* and *scapularis*.

**DISTRIBUTION** (fig. 2). *Aedes synchytus* is known only from Iguazu Falls, Misiones, Argentina. Material examined: 43 specimens; 1 male, 42 females.

**ARGENTINA.** Misiones: Cataratas del Iguazu, type series, see above.

## OBTURBATOR SUBGROUP

### 20. *Aedes (O.) obturbator* Dyar and Knab

Figs. 2,41,42,43

1907. *Aedes obturbator* Dyar and Knab, 1907:9. TYPE: *Holotype* female, Tarpon Bay (Tar-pum Bay), Eleuthera Island, Bahama Islands, 7 July 1903, T. H. Coffin [USNM, 10141].

*Aedes (Ochlerotatus) obturbator* of Dyar (1922a:52; 1928:163); Edwards (1932:142); Lane (1939:112; 1953:653); Maldonado-Capriles, Pippin and Kuns (1958:67-68); Stone, Knight and Starcke (1959:150); Forattini (1965:365); Porter (1967:37,39,40); Belkin, Heinemann and Page (1970:151-152).

*Aedes (Heteronychia) obturbator* of Dyar (1920:105).

*Aedes obturbator* of Johnson (1908:70); Howard, Dyar and Knab (1917:778-779); Dyar (1918a:77; 1924a:117).

**FEMALE** (figs. 41,42). Wing: 3.25 mm. Proboscis: 2.30 mm. Forefemur: 2.05 mm. Abdomen: 2.75 mm. Pleural integument tan to brown, much lighter in color than in remainder of Scapularis Group. **Head:** Occipital dorsolateral dark scale patch much reduced. Pedicel uniformly tan or yellow in color. Palpus 3 segmented. **Thorax:** Scutum with pale tan scales except for dark brown scales in very narrow acrostichal line and narrow line or patch near scutal angle and in supraalar area, and white to yellow scales surrounding prescutellar bare space. Acrostichal, anterior dorsocentral and posterior fossal setae well developed. **Legs:** Relatively long, forefemur about 1.20 of distance from top of thorax to apex of midcoxa. Forecoxa without dark scales. Light scaling on femora, tibiae, and tarsae much reduced; femora with white scales only on posteroventral surface and in small posterior knee spot; tibiae and tarsi entirely dark scaled. Claws of foreleg and midleg with submedian tooth, or posterior claw of foreleg and midleg with tooth reduced or absent; claws of hindleg with submedian tooth. **Wing:** Scales entirely dark. **Abdomen:** Terga II-VI with narrow basal white bands.

**MALE** (figs. 41,42). Wing: 3.00 mm. Proboscis: 2.55 mm. Forefemur: 1.75 mm. Abdomen: 2.95 mm. **Head:** Palpus relatively short, subequal in length to proboscis; segments 2 and 3 long, making up about 0.80 of palpus, segments 4 and



5 short, making up 0.10 and 0.07 of palpus, respectively; segment 3 straight and uniformly slender to apex, segments 4 and 5 slender and straight, segments 3 and 5 with few short setae near apex. **Thorax:** Scutal ornamentation similar to female, but pale tan scales more extensive, extending laterally nearly to scutal angle and to scutal margin in supraalar area. **Legs:** Relatively long, forefemur about 1.20 of distance from top of thorax to apex of midcoxa. Anterior claw of foreleg and midleg with blunt submedian tooth and without acute basal tooth; claws of hindleg with acute median tooth. **Abdomen:** Terga with broad basal bands of white scales.

**MALE GENITALIA** (fig. 41). **Segment IX:** Anterior middorsal emargination of tergum broadly conical, caudal bridge connecting tergal lobes relatively broad; tergal lobes about as broad as high, with 3-6 setae. **Sidepiece:** Length about 3.5-4.0 times median width; tergal surface with sparse, short setae from basal fourth to near base of apical lobe, and 3-4 extremely long, thick subapicotergal setae, laterotergal surface with 1 or 2 extremely long setae arising near basal fourth; sternomesal margin with 40-50 well developed setae; apical tergomesal lobe poorly developed; basal tergomesal lobe conical, differentiated seta tapered gradually from base to apex, apex usually hooked, with about 12-20 undifferentiated setae. **Claspette:** Stem uniformly narrow, curved dorsad, more abruptly near distal third; filament long, with basal two-thirds uniformly narrow and straight, then expanded, with small, sharply retrorse process, and tapered to acute, recurved tip. **Clasper:** Broadly expanded near middle, sharply curved inward distally; spiniform length about 20 times its greatest width. **Phallosome:** Aedeagus ovate.

**PUPA.** Unknown.

**LARVA** (fig. 43). Head: 0.60 mm. Siphon: 0.75 mm. Anal Saddle: 0.28 mm. **Thorax:** Spicules of integument sparse, inconspicuous, length about 3 times basal diameter. Seta 3-P single. Seta 7-P double. **Abdomen:** Seta 6-I-VI single. Seta 13-III strongly developed, double, subequal to 13-IV,V, which are double or triple. **Segment VIII:** Comb scales moderate in size, evenly fringed, about 20 in number. **Siphon:** With acute ventroapical prolongation, subequal in length to ventrolateral valve. Index about 3.0. Pecten with teeth evenly spaced, extending beyond middle of siphon. Seta 1-S inserted distad of pecten. **Anal Segment:** Saddle with relatively large spicules on dorsocaudal margin. Seta 1-X double. Ventral brush (4-X) with 7 pairs of setal tufts.

**SYSTEMATICS.** *Aedes obturbator* can be separated from the other species of the Scapularis Group by the following characters: in the **female** (1) the scutum is covered with pale tan scales except for dark brown scales in a very narrow acrostichal line and on the scutal margin and (2) the pleural integument is very light brown; in the **male genitalia** (1) the claspette filament is very long, narrow and nearly straight, with a small retrorse process, (2) the spiniform is long, about 20 times its greatest width, and (3) 1 or 2 very long, thick setae arise from the lateral surface of the base of the sidepiece; in the **larva** (1) the siphon has a conspicuous ventroapical prolongation about equal in length to the ventrolateral valve and (2) seta 6-I,II is single.

Only females of this species are known from the type locality in the Bahama Islands. I am considering the specimens from Mona Island, Puerto Rico of females, males and larvae (Maldonado-Capriles, Pippin and Kuns, 1958:67-68) to be conspecific with *obturbator*, the females from the two localities being indistinguishable.

The relationships between *obturbator* and the other members of the Scapularis Group are obscure. The scutal scaling of *obturbator* resembles that of *trivittatus*, although the lines of pale tan scales corresponding to the dorsocentral lines of white to yellow scales in *trivittatus* are much broader in *obturbator*, and correspondingly



the dark brown scales of the acrostichal line and especially the lateral scutal margin are much reduced in extent. The male genitalia and immature stages of *obturbator* give no indication of close affinities to other Scapularis Group species.

**BIONOMICS.** Maldonado-Capriles, Pippin and Kuns (1958:67) report collecting *obturbator* larvae from semipermanent rockpools and cement catchment basins and taking adults feeding day and night on Mona Island, Puerto Rico. This species apparently has not been taken in the Bahama Islands since Coffin collected the type series in 1903.

**DISTRIBUTION** (fig. 2). *Aedes obturbator* is known only from Eleuthera Island in the Bahama Islands and Mona Island between Puerto Rico and Hispaniola. Material examined: 36 specimens; 4 males, 30 females, 2 larvae; 2 individual rearings (2 incomplete).

**BAHAMA ISLANDS.** Eleuthera Island, Tarpon [Tarpum] Bay, 1903, T. Coffin, 19 F [USNM, BM]; same locality and collector, 7 July 1903, 1 F (*obturbator* holotype) [USNM].

**PUERTO RICO.** Mona Island, Feb-Nov 1955, W. Pippin, 2 lf, 4 M, 8 F [USNM].

## PECTINATUS SUBGROUP

### 21. *Aedes* (O.) *pectinatus* Arnell, sp. n.

Figs. 1,44,45

**TYPES.** *Holotype* female (COB 1), Rio Cuja, nr. Fusagasuga, Cundinamarca, Colombia, elev. 1400 m, larva from rock hole in stream margin, 29 Oct 1964, E. Osorno et al. [USNM]. *Allotype* male (COB 1) with genitalia slide (690210-19), same data as holotype [USNM]. *Paratypes*: 1 F (COB 1), 1 M (COB 1) with genitalia slide (741023-1), 4 lp (COB 1-10,11,12,13), same data as holotype [UCLA, USNM].

**FEMALE** (fig. 44). Wing: 4.15 mm. Proboscis: 2.70 mm. Forefemur: 1.95 mm. **Head**: Occipital dorsolateral dark scale patch large and conspicuous; erect scales numerous, elongate, extending far forward on occiput, mostly dark. Proboscis long, about 1.60 of forefemur. **Thorax**: Scutal scales entirely dark brown except for few white scales above paratergite. Acrostichal and dorsocentral setae absent anteriorly. Scutellum with dark scales on lobes. **Legs**: Conspicuous knee spots of white scales present on apices of femora. Tibiae and tarsae entirely dark scaled. Claws of hindleg with submedian tooth. **Wing**: Scales entirely dark. **Abdomen**: Terga entirely dark scaled dorsally.

**MALE** (fig. 44). Wing: 4.35 mm. Proboscis: 3.05 mm. Forefemur: 2.20 mm. Abdomen: 4.05 mm. **Thorax**: Scutum with white scales in broad patch on posterior half between dorsocentral lines, patch with narrow anterior projection along acrostichal line which does not reach anterior promontory; remainder of scutum with dark scales. **Legs**: Anterior claw of foreleg and midleg considerably enlarged, with blunt submedian and acute basal tooth.

**MALE GENITALIA** (fig. 44). **Segment IX**: Anterior middorsal emargination of tergum deep, rectangular to pandurate in shape; caudal bridge connecting tergal lobes very narrow; tergal lobes broader than high, with 5-7 setae. **Sidepiece**: Length about 4 times median width; sternomesal margin with about 20-30 setae in irregular double row; apical tergomesal lobe not developed; basal tergomesal lobe conical, differentiated seta expanded and slightly curved before middle and straight beyond middle, with about 20 undifferentiated setae. **Claspette**: Stem long, uniformly narrow and broadly curved dorsad; filament slightly longer than stem, narrow at base, expanded at middle into broadly obtuse outer angle or small, sharply retrorse



process, and tapered to recurved tip. **Clasper:** Broadly curved inward distally; spiniform length about 10 times its greatest width. **Phallosome:** Aedeagus ovate.

**PUPA** (fig. 44). Abdomen: 4.05 mm. Trumpet: 0.70 mm. Paddle: 1.00 mm. **Cephalothorax:** Weakly pigmented, slightly darker dorsally. **Abdomen:** Weakly pigmented, dark at base of segment III. Seta 1-II 22-27 branched. Seta 5-IV,V long, about 1.5 times length of succeeding tergum, usually double on segment IV (1-2b), always single on segment V; seta 5-VI subequal in length to length of succeeding tergum, single. **Paddle:** Seta 1-P long, single, about 0.33 of paddle length.

**LARVA** (fig. 45). Head: 1.00 mm. Siphon: 1.05 mm. Anal Saddle: 0.40 mm. **Head:** Seta 5-C triple (2-3b). Seta 6-C 2-3 branched. Mental plate with lateral 4 or 5 teeth much reduced, median teeth normal or slightly enlarged. **Thorax:** Spicules of integument moderately dense, thickened basally, length about 6 times basal diameter. Seta 3-P 4(3-5) branched. **Abdomen:** Seta 1-VII very strongly developed, single, subequal to siphon length. Seta 13-III strongly developed, single. **Segment VIII:** Comb scales small in size, spatulate and evenly fringed, 60-70(55-85) in number, in large triangular patch. **Siphon:** Index about 2.8-2.9. Pecten teeth 20-24, distal 4-6 teeth without basal denticles and slightly detached; pecten extending to distal 0.75-0.80 of siphon. Seta 1-S 4(3-5) branched, inserted within pecten, at about distal 0.70 of siphon. **Anal Segment:** Ventral brush (4-X) with 8 pairs of setal tufts, all arising from grid. Anal gills long, about 6 times dorsal saddle length.

**SYSTEMATICS.** *Aedes pectinatus* can be separated from the other species of the Scapularis Group by the following characters: in the **female** (1) the scutum is entirely dark brown scaled and (2) knee spots of white scales are present on the apices of the femora; in the **male genitalia** (1) the sternomesal margin of the sidepiece has only 20 to 30 relatively short setae, (2) the apical tergomesal lobe of the sidepiece is not developed, (3) the differentiated seta of the basal tergomesal lobe is usually not curved distad of the middle, and (4) the claspette filament is without or has a small retrorse process; in the **larva** (1) the pecten teeth extend beyond the insertion of seta 1-S and (2) the comb scales number 60-70.

One of the most aberrant species of the Scapularis Group, *pectinatus* exhibits a number of characters found nowhere else in the group. Although the males of most species of the group are less distinct in scutal and abdominal scale patterns than the females, *pectinatus* is the only species to exhibit true sexual dimorphism, the female having a completely dark scaled scutum and the male having a broad patch of white scales on the posterior half of the scutum. The numerous, completely dark erect occipital scales and the very long proboscis in the female, the absence of the apical tergomesal lobe of the sidepiece and the reduction in setae on the sternomesal margin of the sidepiece of the male genitalia, and the large number of comb scales and pecten teeth, the extreme development of seta 1-VII and the reduction in the lateral teeth of the mental plate in the larva all point to an early divergence from the main line of Scapularis Group evolution.

**BIONOMICS.** The only information on the bionomics of *pectinatus* is from the collection records for the type series. The larvae were collected from a rockhole at the margin of the Rio Cuja in an area of coffee plantations and second growth forest. The water in the rockhole was semipermanent and no vegetation was present. Associated with *pectinatus* were larvae of *Aedes* (O.) *scutellalbum*, *A.* (O.) *fluvialis*, *Culex* (C.) sp near *articularis* and *Culex* (Cu.) sp near *coronator*.

**DISTRIBUTION.** *Aedes pectinatus* is known only from 2 localities near Bogota, Cundinamarca, Colombia. Material examined: 13 specimens; 3 males, 2 females, 4 pupae, 4 larvae; 4 individual rearings (incomplete).

**COLOMBIA.** Cundinamarca: El Colegio, 1750 m, 8 Nov 1940, Bates and Osorno, 1 M [USNM]. Rio Cuja, nr. Fusagasuga, type series, see above.



## THELCTER SUBGROUP

22. *Aedes (O.) thelcter* Dyar

Figs. 1,46,47,48

1918. *Aedes (Taeniorhynchus ?) thelcter* Dyar, 1918b:129. TYPE: *Holotype* female, Brownsville, Texas, U.S.A., 29 Aug 1916, M. M. High [USNM, 21718].
1947. *Aedes (Ochlerotatus) keyensis* Buren, 1947:228-229. TYPE: *Holotype* female, Key West, Florida, U.S.A., 15 Oct 1946, E. Fernandez [A]. Synonymy with *thelcter* by Thurman, Haeger and Mulrennan (1949:171).

*Aedes (Ochlerotatus) thelcter* of Dyar (1922a:60; 1928:169); Dyar and Ludlow (1922:62-63); Edwards (1932:143); Martini (1935:51-52); Matheson (1944:160); Thurman, Haeger and Mulrennan (1949:171); Carpenter and La Casse (1955:240-241); Vargas (1956:24); Stone, Knight and Starcke (1959:155).

*Aedes (Heteronychia) thelcter* of Dyar (1922b:52).

*Aedes thelcter* of Dyar (1924a:118; 1924b:132).

**FEMALE** (figs. 46,47). Wing: 3.55 mm. Proboscis: 2.40 mm. Forefemur: 1.70 mm. Abdomen: 3.25 mm. **Head:** Eyes rather broadly separated, interocular space about 3 ommatidial diameters. Occipital dorsolateral dark scale patch often reduced or absent. Palpus 4 segmented. **Thorax:** Scutal scales entirely yellowish white except for light brown to golden scales in broad acrostichal line extending to posterior third of scutum or occasionally to prescutellar bare space; scales in acrostichal area occasionally only slightly darker than surrounding scales making acrostichal line indistinct. Acrostichal setae confined to anterior promontory, anterior dorsocentral setae not developed. Scutellum with white scales, broader than scutal scales, in large patch on midlobe and often small patch on lateral lobes. Lobes with 10 to 15 strong setae. *Ppn* covered with narrow, curved golden scales except for patch of broad white scales posterioventrally. Scale patch on *ssp* usually extensive, with a few scales extending dorsad toward *ppn*. **Legs:** Short, forefemur about 0.85-0.90 of distance from top of thorax to apex of midcoxa. White scales on femora, tibiae and basal tarsal segments usually more extensive but in same pattern as in remainder of group. Claws of hindleg with acute submedian tooth. **Wing:** Scales entirely dark. **Abdomen:** Terga II-VI or VII with basomedian white scale patches, broader on midline, often extending to distal margin of terga forming distinct median longitudinal white line on entire length of abdomen; basolateral white scale patches large, often extending to distal margin of tergum. Sternum entirely white scaled.

**MALE** (figs. 46,47). Wing: 3.00 mm. Proboscis: 2.15 mm. Forefemur: 1.45 mm. Abdomen: 3.15 mm. Generally similar to female except for sexual differences. **Head:** Proboscis long, about 1.55 of forefemur. Palpus about 1.10 of proboscis; segments 2 and 3 making up about 0.52 of palpus; segments 4 and 5 each making up about 0.21 of palpus; segment 3 slightly elevated and swollen near apex, segment 5 slightly downturned at base; apex of segment 3, segment 4 and base of segment 5 densely covered with well developed setae ventrally. Antenna about 0.75 of proboscis. **Thorax:** Scutal scales entirely yellowish white except for broader white scales surrounding prescutellar bare space. **Legs:** Anterior claw of foreleg moderately enlarged, with blunt submedian tooth. **Abdomen:** Terga with narrow basal bands of white scales.

**MALE GENITALIA** (fig. 47). **Segment IX:** Anterior middorsal emargination of



tergum broad and shallow, caudal bridge connecting tergal lobes very broad; tergal lobes broad, with 3-8 setae. **Sidepiece:** Short and broad, length about 2.5 times median width; tergal surface with few short to moderate setae and 1-3 long, thick subapicotergal setae; sternomesal margin with about 20 moderately long setae; apical tergomesal lobe moderately developed, with row of 3-4 short setae on mesal margin; basal tergomesal lobe prominent, triangular, differentiated seta relatively small, often only slightly longer than largest of about 25-35 undifferentiated setae. **Claspette:** Stem short, narrowed and slightly angled dorsad distally; filament narrow at base, expanded near basal fourth into obtuse outer angle; often with small retrorse barb, and gradually tapered distally to recurved tip. **Clasper:** Sharply curved inward distally; spiniform relatively short, length about 10 times its greatest width. **Phallosome:** Aedeagus ovate.

**PUPA** (fig. 47). Abdomen: 2.90 mm. Trumpet: 0.45 mm. Paddle: 0.75 mm. **Cephalothorax:** Weakly pigmented, considerably darker dorsally. **Abdomen:** Weakly pigmented, darker anteriorly and at base of most segments. Seta 5-IV-VI subequal in length to length of succeeding tergum, double, rarely single on segments IV and VI. Seta 6-VII short, dendritic, with about 12-18 main branches. **Paddle:** Marginal spicules extremely poorly developed.

**LARVA** (fig. 48). Head: 0.80 mm. Siphon: 0.80 mm. Anal Saddle: 0.40 mm. **Head:** Broad, width about 1.6 of length. **Thorax:** Spicules of integument sparse and short, length about 2 times basal diameter. Seta 3-P triple (1-3b). Seta 1-M triple (2-4b). **Abdomen:** Seta 1-IV 4-6(4-8) branched; seta 1-V 3(3-5) branched; seta 1-VII 3-4(2-5) branched. Seta 3-IV 5(4-8) branched; seta 3-V 4(3-5) branched. Seta 13-III weakly developed, 8(6-10) branched. **Segment VIII:** Comb scales moderate in size, with well differentiated median spinule and 1-3 smaller lateral spinules, about 16-21 in number, in irregular single to triple row. **Siphon:** Index about 1.9-2.05. Pecten with distal 2 or 3 teeth detached, extending to about distal 0.70-0.75 of siphon. Seta 1-S inserted slightly basad of middle of siphon, 9-13 branched. **Anal Segment:** Seta 1-X double (1-4b). Seta 2-X 15(14-19) branched. Ventral brush (4-X) with 9 pairs of setal tufts.

**SYSTEMATICS.** *Aedes thelcter* can be separated from the other species of the Scapularis Group by the following characters: in the female (1) the scutal scales are entirely yellowish white except for a usual broad acrostichal line of light brown to golden scales and (2) the abdominal terga have basal bands of white scales which are usually expanded on the midline and often form a median longitudinal white line the entire length of the abdomen; in the male genitalia (1) the sidepiece is short and broad, length about 2.5 times median width and (2) the basal tergomesal lobe of the sidepiece has 25-35 setae; in the larva (1) the pecten teeth extend beyond the insertion of seta 1-S and (2) the comb scales number about 16-20.

*Aedes thelcter* shows no close affinities to any other Scapularis Group species. The structure of the male genitalia with the compact sidepiece, densely hirsute basal tergomesal lobe and short claspette, and the relatively short and broad cercus of the female genitalia set this species apart from the remainder of the group. Probably less significant but obvious characters are the unusual scutal and abdominal scaling of the adult and the extensive row of larval pecten teeth.

**BIONOMICS.** *Aedes thelcter* is found commonly in irrigation overflow pools and temporary rain pools in the lower Rio Grande valley. Miller, Doll and Wheeler (1964:459) report collecting *thelcter* on the Pecos River near Artesia, New Mexico following flash floods which inundated large areas of *Tamarix* marshes that had not held water for several years. In this collection of *thelcter* were also larvae of *Psor-*



*ophora* (G.) *discolor*, *P. (G.) confinnis*, *P. (G.) signipennis*, *P. (J.) cyanescens*, *Aedes* (*Aedm.*) *vexans*, *A. (O.) dorsalis* and *A. (O.) sollicitans*. *Aedes thelcter* was collected in considerable numbers in light traps in the lower Rio Grande valley during VEE surveillance activities in 1971 (Sudia and Newhouse, 1975). Thurman, Haeger and Mulrennan (1949) describe in detail the breeding habitat of *thelcter* at Long Key and Rock Harbor in the Florida Keys, in rain-filled, shallow pools in limestone, with several species of *Psorophora* and *Aedes* and *Deinocerites cancer* being associated with *thelcter*. Numerous collections of *thelcter* have been taken in light traps in the Florida Keys.

*Aedes thelcter* appears to be a significant vector of VEE in Texas. This is discussed under Medical Importance above.

**DISTRIBUTION.** *Aedes thelcter* is known from the Florida Keys and from the Rio Grande Valley of Texas and southern New Mexico northeastward to central Oklahoma. It undoubtedly occurs in northeastern Mexico; however, the records of *thelcter* from Jalisco by Vargas (1956:23) and Los Mochis, Sinaloa by Martini (1935:51) are probably in error. Material examined: 136 specimens; 16 males, 101 females, 4 pupae, 15 larvae; 4 individual rearings (3 larval, 1 incomplete).

**UNITED STATES. Florida:** Key West, 14-21 Oct 1946, [E. Fernandez], 7 F [USNM]. Long Key, 5 Dec 1947, J. Haeger, 1 lpM (32) [USNM]; same locality and collector, 9 Dec 1947, 1 F [USNM]; same locality and collector, 29 Dec 1947, 2 lpF (1,42), 1 lp (56) [USNM]. **Texas:** Brownsville, 29 Aug 1916, M. High, 33 F [USNM, BM]; same data, 1 F (*thelcter* holotype) [USNM]. Brownsville, 12-15 Feb 1924, R. Turner, 9 M, 13 F [USNM]; same locality and collector, 20 Mar 1924, 1 M, 1 F [USNM]. Brownsville, Oct 1932, A. Niven, 1 F [USNM]; same locality and collector, 5-8 July 1933, 1 F [USNM]. Brownsville, 15 Apr 1942, W. Reeves, B. Brookman and R. Eads, 1 M [USNM]. Brownsville, 10 Aug 1944, C. Joyce, 4 L [USNM]. Brownsville, Apr 1940, 1 F [BM]. Brownsville, Brooklyn Mus. Coll., 1 M [USNM]. Corpus Christi, 29 June-8 July 1924, R. Turner, 5 F [USNM]. Glasscock Co., 23 Aug 1971, 6 F [JFR]. Howard Co., 9 Aug 1971, 9 F [JFR]. Mission, 23 Feb-8 Apr 1924, R. Turner, 2 M, 3 F, 3 L [USNM, BM]. Pecos Co., 20 Aug 1971, 1 F [JFR]. Rio Grande Valley, Oct 1923, R. Turner, 2 F [USNM]. San Antonio, 16 Sept 1942, E. Ross, 1 M, 4 F [USNM]. Sonora, 12 June 1934, E. Cushing, 1 F [USNM]. Valverde Co., 11,26 Aug 1971, 8 F [JFR]. Webb Co., 2 June 1943, 1 F, 3 L [USNM].

#### Additional Records from the Literature

**UNITED STATES. New Mexico:** Artesia (Miller, Doll and Wheeler, 1964:459). **Oklahoma:** Anadarko; Clinton; Guthrie; Hollis; Walters; Watonga (Griffith, 1952:10).

### SUBGROUP UNKNOWN

#### 23. *Aedes (Ochlerotatus)* sp., Surinam form

##### Fig. 1

**FEMALE.** Medium sized species. Wing: 2.75 mm. Forefemur: 1.20 mm. Abdomen: 2.20 mm. **Head:** Decumbent scales of vertex and occiput white mesally with large dark scale patch dorsolaterally. Proboscis entirely dark scaled. **Thorax:** Integument dark brown. Acrostichal and dorsocentral setae confined to anterior promontory; prescutellar and supraalar setae well developed. Scutellum with about 6 strong setae on lobes. Scutum with narrow acrostichal line of silvery white scales from anterior promontory to scutellum; remainder of scutum with dark brown



scales. Scutellum with large patch of silvery white scales on median lobe and small patch of dark brown scales on lateral lobes. *Apn* scales entirely dark. **Legs:** Forecoxa with large patch of dark scales. Knee spots of white scales at apices of femora absent. Hindtibia entirely dark scaled. **Wing:** Entirely dark scaled. **Abdomen:** Terga II-VI with basolateral white scale patches; entirely dark scaled dorsally. Sternum either entirely dark scaled or white scaled with dark scales distally on segments.

MALE, PUPA, LARVA. Unknown.

**SYSTEMATICS.** This form can be separated from the other species of the Scapularis Group by the narrow acrostichal line of silvery white scales with the remainder of the scutum being entirely dark brown scaled and the absence of dorsocentral setae except on the anterior promontory. It appears to belong to the Scapularis Group but its placement within the group is uncertain, although it most closely resembles the Bogotanus Subgroup. The 2 specimens of the form are indistinguishable from each other except for the scales of the sternum, the Colombian specimen being entirely dark scaled and the Surinam specimen white scaled with dark scales distally on each segment.

**BIONOMICS.** The Colombian specimen was apparently reared from a larva taken from clear water at the grassy margin of a large pond in a pasture and associated with several species of *Anopheles*, *Uranotaenia* and *Culex*. Nothing is known of the bionomics of the Surinam specimen.

**DISTRIBUTION** (fig. 1). This form is known from Surinam and low elevation Colombia. Material examined: 2 specimens; 2 females.

**COLOMBIA.** *Meta:* Laguna de la Palmita, nr. Villavicencio, 12 May 1947, L. Rozeboom (CV 377), 1 F [UCLA].

**SURINAM.** *Suriname:* Zanderij, 17-22 June 1964 (SUR 116), 1 F [USNM].

#### 24. *Aedes (Ochlerotatus)* sp., Colombian form

**FEMALE.** Medium sized species. Wing: 3.05 mm. Proboscis: 1.95 mm. Forefemur: 1.55 mm. Abdomen: 2.20 mm. **Head:** Decumbent scales of vertex and occiput entirely white. Proboscis relatively short, length about 1.25 of forefemur, entirely dark scaled. **Thorax:** Integument moderately light brown. Acrostichal setae confined to anterior promontory; anterior dorsocentral setae absent except on promontory; prescutellar and supraalar setae well developed. Scutellum with 4-6 setae on lobes. Scutal scales entirely dark brown. Scutellum with white scales on midlobe. *Apn* with few dark scales; *psp* and *ssp* scales few. **Legs:** Forecoxa with scales entirely white. Knee spots of white scales at apices of femora absent. Hindtibia entirely dark scaled. **Wing:** Entirely dark scaled. **Abdomen:** Terga II-VI with basolateral white scale patches; entirely dark scaled dorsally. Sternum white scaled with dark scales distally on segments.

MALE, PUPA, LARVA. Unknown.

**SYSTEMATICS.** This form can be separated from the other species of the Scapularis Group by the entirely dark scaled scutum, the absence of knee spots of white scales on the apices of the femora and the absence of dark scales on the occiput. I have declined to name this species because of the absence of collection data and uncertain placement due to lack of stages other than the female. It resembles *incomp-tus* in most respects and may be related to that eastern Panamanian species.

**DISTRIBUTION.** This form is known from an unspecified locality in Colombia. Material examined: 6 specimens; 6 females.

**COLOMBIA.** *Locality unknown:* (COR 494), 6 F [UCLA, USNM].



## REFERENCES CITED

Abdel-Malek, Albert

1948. The biology of *Aedes trivittatus*. J. Econ. Entomol. 41:951-954.

1949. A study of the morphology of the immature stages of *Aedes trivittatus* (Coquillett) (Diptera:Culicidae). Entomol. Soc. Am., Ann. 42:19-37.

Aiken, James

1907. Notes on the mosquitoes of British Guiana. Br. Guiana Med. Annu. 1906 (1907):59-78.

Aitken, Thomas H. G.

1957. Virus transmission studies with Trinidadian mosquitoes. West Indian Med. J. 6:229-232.

1960. A survey of Trinidadian arthropods for natural virus infections (August, 1953 to December, 1958). Mosq. News 20:1-10.

Anderson, Charles R., T. H. G. Aitken, L. P. Spence and W. G. Downs

1960. Kairi virus, a new virus from Trinidadian forest mosquitoes. Am. J. Trop. Med. Hyg. 9:70-72.

Anderson, Charles R., L. P. Spence, W. G. Downs and T. H. G. Aitken

1960. Manzanilla virus: A new virus isolated from the blood of a howler monkey in Trinidad, W.I. Am. J. Trop. Med. Hyg. 9:78-80.

Antunes, Pablo C. A. and J. Lane

1934. Notes on some species of *Aedes* (*Ochlerotatus*) (Diptera, Culicidae). Rev. Biol. Hyg. 5:35-40.

Arnett, Ross H.

1949. Notes on the distribution, habits and habitats of some Panama culicines (Diptera:Culicidae). N. Y. Entomol. Soc., J. 57:233-251.

Barr, A. Ralph

1958. The mosquitoes of Minnesota (Diptera:Culicidae:Culicinae). Univ. Minn. Agric. Exp. Stn. Tech. Bull. 228. 154 p.

Belkin, John N.

1962. The mosquitoes of the South Pacific (Diptera, Culicidae). Berkeley, Univ. Calif. Press. 2 vol.

1968. Mosquito Studies (Diptera, Culicidae). IX. The type specimens of New World mosquitoes in European museums. Am. Entomol. Inst., Contrib. 3(4). 69 p.

Belkin, John N., S. J. Heinemann and W. A. Page

1970. The Culicidae of Jamaica (Mosquito Studies, XXI). Am. Entomol. Inst., Contrib. 6(1). 458 p. (Also published as Inst. Jam., Bull. Sci. Ser. 20).

Belkin, John N., R. X. Schick, P. Galindo and T. H. G. Aitken

1965. Mosquito Studies (Diptera, Culicidae). I. A project for a systematic study of the mosquitoes of Middle America. Am. Entomol. Inst., Contrib. 1(2):1-17.

Belkin, John N., R. X. Schick and S. J. Heinemann

1968. Mosquito Studies (Diptera, Culicidae). XI. Mosquitoes originally described from Argentina, Bolivia, Chile, Paraguay, Peru, and Uruguay. Am. Entomol. Inst., Contrib. 4(1):9-29.

1971. Mosquito Studies (Diptera, Culicidae). XXV. Mosquitoes originally described from Brazil. Am. Entomol. Inst., Contrib. 7(5). 64 p.



Blanchard, Raphael

1905. Les moustiques. Histoire naturelle et medicale. Paris, de Rudeval. 673 p.

Bond, James O., W. McD. Hammon, A. L. Lewis, G. E. Sather and D. J. Taylor

1966. California group arboviruses in Florida and a report of a new strain, Keystone virus. Public Health Rep. 81:607-613.

Bonne, Cornelis and J. Bonne-Wepster

1925. Mosquitoes of Surinam. R. Colon. Inst. Amst., Afd. Trop. Hyg. 13. 558 p.

Bonne-Wepster, Jean and C. Bonne

1923. A list of mosquitoes from Dutch Guiana. Insecutor Inscitiae Mens. 11: 123-127.

Bradley, George H., R. F. Fritz and L. E. Perry

1944. Additional mosquito records for the southeastern states. J. Econ. Entomol. 37:109.

Branch, Nina, L. Logan, E. C. Beck and J. A. Mulrennan

1958. New distributional records for Florida mosquitoes. Fla. Entomol. 41: 155-163.

Breeland, Samuel G., W. E. Snow and E. Pickard

1961. Mosquitoes of the Tennessee Valley. Tenn. Acad. Sci., J. 36:249-319.

Breland, Osmond P.

1951. The immature stages of *Aedes infirmatus* Dyar and Knab with notes on related species (Diptera:Culicidae). Entomol. Soc. Am., Ann. 44:362-371.

Brethes, Juan

1910. Dipteros nuevos o poco conocidos de Sud-America. Mus. Nac. B. Aires, An. 20:469-472.

1916. Algunas notas sobre mosquitos Argentinos, su relacion con las enfermedades paludicas, etc. y descripcion de tres especies nuevas. Mus. Nac. B. Aires, An. 28:193-218.

1917. Description d'une nouvelle espece de moustique de Buenos Aires. Physis 3:226-229.

Bugher, John C., J. Boshell-Manrique, M. Roca-Garcia and E. Osorno-Mesa

1944. Epidemiology of jungle yellow fever in eastern Colombia. Am. J. Hyg. 39:16-51.

Buren, William F.

1947. A new *Aedes* from the Florida Keys (Diptera, Culicidae). Entomol. Soc. Wash., Proc. 49:228-229.

Carpenter, Stanley J. and W. J. LaCasse

1955. Mosquitoes of North America (north of Mexico). Berkeley, Univ. Calif. Press. 360 p.

Causey, Ottis R., C. E. Causey, O. M. Maroja and D. G. Macedo

1961. The isolation of arthropod-borne viruses, including members of two hitherto undescribed groups, in the Amazon region of Brazil. Am. J. Trop. Med. Hyg. 10:227-249.

Causey, Ottis R. and H. W. Kumm

1948. Dispersion of forest mosquitoes in Brazil. Preliminary studies. Am. J. Trop. Med. 28:469-480.

Cerqueira, Nelson L.

1943. Lista dos mosquitos da Bolivia (Diptera, Culicidae). Inst. Oswaldo Cruz, Mem. 39:15-36.

1961. Distribuicao geografica dos mosquitos da Amazonia (Diptera, Culicidae, Culicinae). Rev. Bras. Entomol. 10:111-168.



Coher, Edward I.

1948. A study of the female genitalia of Culicidae: with particular reference to characters of generic value. Entomol. Am. 28:75-111.

Coquillett, Daniel W.

1902. New forms of Culicidae from North America. N. Y. Entomol. Soc., J. 10: 191-194.  
1906a. New Culicidae from the West Indies. Entomol. Soc. Wash., Proc. 7:182-186.  
1906b. A classification of the mosquitoes of North and Middle America. U.S. Bur. Entomol., Tech. Ser. 11. 31 p.  
1910. The type-species of the North American genera of Diptera. U.S. Natl. Mus., Proc. 37:499-647.

Craig, George B., Jr. and W. R. Horsfall

1960. Eggs of floodwater mosquitoes. VII. Species of *Aedes* common in the southeastern United States (Diptera:Culicidae). Entomol. Soc. Am., Ann. 53: 11-18.

Darsie, Richard F., Jr.

1951. Pupae of the culicine mosquitoes of the northeastern United States (Diptera, Culicidae, Culicini). Cornell Univ. Agric. Exp. Stn., Mem. 304. 67 p.

Davis, David E.

1944. Larval habits of some Brazilian mosquitoes. Rev. Entomol. 15:221-235.

Davis, Nelson C. and R. C. Shannon

1929. Studies on yellow fever in South America. V. Transmission experiments with certain species of *Culex* and *Aedes*. J. Exp. Med. 50:803-808.

De Foliart, Gene R., R. O. Ainslow, R. P. Hanson, C. D. Morris, O. Papadopoulos and G. E. Sather

1969. Isolation of Jamestown Canyon serotype of California encephalitis virus from naturally infected *Aedes* mosquitoes and tabanids. Am. J. Trop. Med. Hyg. 18:440-447.

De Foliart, Gene R., R. O. Ainslow, W. H. Thompson, R. P. Hanson, R. E. Wright and G. E. Sather

1972. Isolations of Trivittatus virus from Wisconsin mosquitoes, 1964-1968. J. Med. Entomol. 9:67-70.

Del Ponte, Eduardo, M. P. Castro and M. Garcia

1951. Clave para las especies de *Psorophora* y *Aedes* de la Argentina y comarcas vecinas. Soc. Cient. Argent., An. 151:228-243.

Downs, Wilbur G., L. Spence, T. H. G. Aitken and L. Whitman

1961. Cache Valley virus isolated from a Trinidadian mosquito, *Aedes scapularis*. West Indian Med. J. 10:13-15.

Duret, Jose P. and M. P. Barreto

1956. Notas sobre culicidas do estado de Sao Paulo, Brasil, com descricoes de tres novas especies de *Culex* (Diptera, Culicidae). Rev. Bras. Entomol. 5:81-99.

Dyar, Harrison G.

- 1905a. Remarks on genitalic genera in the Culicidae. Entomol. Soc. Wash., Proc. 7:42-49.  
1905b. Brief notes on mosquitoes. N. Y. Entomol. Soc., J. 13:107-109.  
1905c. Illustrations of the abdominal appendages of certain mosquitoes. N.Y. Entomol. Soc., J. 13:185-188.  
1918a. The male genitalia of *Aedes* as indicative of natural affinities (Diptera, Culicidae). Insecutor Inscitiae Mens. 6:71-86.



- 1918b. New American mosquitoes (Diptera, Culicidae). *Insecutor Inscitiae Mens.* 6:120-129.
1919. A note on Argentine mosquitoes (Diptera, Culicidae). *Insecutor Inscitiae Mens.* 7:85-89.
1920. The classification of American *Aedes*. *Insecutor Inscitiae Mens.* 8:103-106.
1921. The mosquitoes of Argentina (Diptera, Culicidae). *Insecutor Inscitiae Mens.* 9:148-150.
- 1922a. The American *Aedes* of the *scapularis* group (Diptera, Culicidae). *Insecutor Inscitiae Mens.* 10:51-60.
- 1922b. The mosquitoes of the United States. *U.S. Natl. Mus., Proc.* 62:1-119.
1923. The mosquitoes of Panama (Diptera, Culicidae). *Insecutor Inscitiae Mens.* 11:167-186.
- 1924a. Note on the American *Aedes* of the Scapularis group (Diptera, Culicidae). *Insecutor Inscitiae Mens.* 12:117-119.
- 1924b. The larva of *Aedes thelcter* Dyar (Diptera, Culicidae). *Insecutor Inscitiae Mens.* 12:132.
- 1925a. The mosquitoes of Panama (Diptera, Culicidae). *Insecutor Inscitiae Mens.* 13:101-195.
- 1925b. Some mosquitoes from Venezuela (Diptera, Culicidae). *Insecutor Inscitiae Mens.* 13:213-216.
1928. The mosquitoes of the Americas. *Wash., Carnegie Inst. Wash. (Publ. 387).* 616 p.
- Dyar, Harrison G. and F. Knab
- 1906a. The larvae of Culicidae classified as independent organisms. *N. Y. Entomol. Soc., J.* 14:169-230.
- 1906b. Notes on some American mosquitoes with descriptions of new species. *Biol. Soc. Wash., Proc.* 19:159-172.
1907. Descriptions of some American mosquitoes. *N.Y. Entomol. Soc., J.* 15:9-13.
1908. Descriptions of some new mosquitoes from tropical America. *U.S. Natl. Mus., Proc.* 35:53-70.
- Dyar, Harrison G. and C. S. Ludlow
1922. Notes on American mosquitoes (Diptera, Culicidae). *Mil. Surg.* 50:61-64.
- Edwards, Frederick W.
1932. *Diptera. Fam. Culicidae. Genera Insectorum* 194. 258 p.
- Evans, Alwen M.
1921. Notes on Culicidae collected in Venezuela. *Ann. Trop. Med. Parasitol.* 15:445-447.
1922. Notes on Culicidae in Venezuela with descriptions of new species. *Ann. Trop. Med. Parasitol.* 16:213-222.
- Fauran, Pierre
1961. Catalogue annote des Culicides signales en Guyane Francaise. *Inst. Pasteur Guyane Fr. Inini, Arch. Publ.* 465. 60 p.
- Forattini, Oswaldo P.
1961. Some data on the domesticity of *Aedes scapularis* (Rondani) in Sao Paulo, Brazil. *Mosq. News* 21:295-296.
1965. *Entomologia medica. Vol. 2.* Sao Paulo, Univ. Sao Paulo. 506 p.
- Garcia, Miguel and O. H. Casal
1968. Siete especies de Culicidae (Diptera) nuevas para la entomofauna Argentina. *Physis* 28:107-109.



Garcia, Miguel and R. A. Ronderos

1963 (1962). Sobre la validez de *Aedes (Ochlerotatus) patersoni* Shannon y Del Ponte, 1927 (Diptera-Culicidae). Soc. Entomol. Argent., Rev. 25:29-33.

Garcia Avila, Israel and A. V. Gutsevich

1969. Los mosquitos de Cuba como hematofagos del hombre. Torreia, n. s. 15. 7 p.

Gerry, Bertram I.

1932. Morphological studies of the female genitalia of Cuban mosquitoes. Entomol. Soc. Am., Ann. 25:31-75.

Gibson, Arthur

1937. Mosquito suppression work in Canada in 1936. N.J. Mosq. Exterm. Assoc., Proc. 24:96-108.

Giles, George M.

1902. A handbook of the gnats or mosquitoes. Ed. 2. Lond. Bale, Sons and Danielsson. 530 p.

Grabham, Michael

1905. Notes on some Jamaican Culicidae. Can. Entomol. 37:401-411.

1906. Four new Culicidae from Jamaica, West Indies. Can. Entomol. 38:311-320.

Griffith, Melvin E.

1952. Additional species of mosquitoes in Oklahoma. Mosq. News 12:10-14.

Grossbeck, John A.

1904. Description of two new species of *Culex*. Entomol. News 15:332-333.

Hayes, Jack

1965. A first report of *Aedes infirmatus* Dyar and Knab in Illinois. Ill. State Acad. Sci., Trans. 58:151.

Horsfall, William R. and G. B. Craig, Jr.

1956. Eggs of floodwater mosquitoes. IV. Species of *Aedes* common in Illinois (Diptera:Culicidae). Entomol. Soc. Am., Ann. 49:368-374.

Horsfall, William R., R. F. Vorhees and E. W. Cupp

1970. Eggs of floodwater mosquitoes. XIII. Chorionic sculpturing. Entomol. Soc. Amer., Ann. 63:1709-1716.

Howard, Leland O., H. G. Dyar and F. Knab

1917. The mosquitoes of North and Central America and the West Indies. Vol. 4. Systematic description (in two parts). Part II. Wash., Carnegie Inst. Wash. (Publ. 159), p. 525-1064.

Hunter, Walter D.

1900. A catalogue of the Diptera of South America. Part 1, bibliography and Nemocera. Am. Entomol. Soc., Trans. 26:260-298.

Johnson, Charles W.

1908. The Diptera of the Bahamas, with notes and description of one new species. Psyche 15:69-80.

Judd, William W.

1954. Results of a survey of mosquitoes conducted at London, Ontario in 1952 with observations on the biology of the species concerned. Can. Entomol. 96: 101-108.

Knight, Kenneth L.

1970. A mosquito taxonomic glossary. I. Adult head (external). Mosq. Syst. Newsl. 2:23-33.



Knight, Kenneth L. and J. L. Laffoon

1970. A mosquito taxonomic glossary. III. Adult thorax. Mosq. Syst. Newsl. 2: 132-146.

1971. A mosquito taxonomic glossary. V. Abdomen (except female genitalia). Mosq. Syst. Newsl. 3:8-24.

Kokernot, Robert H., J. Hayes, D. H. M. Chan and K. R. Boyd

1969. Arbovirus studies in the Ohio-Mississippi basin, 1964-1967. V. Trivittatus and western equine encephalomyelitis viruses. Am. J. Trop. Med. Hyg. 18: 774-778.

Komp, William H. W.

1936. An annotated list of the mosquitoes found in the vicinity of an endemic focus of yellow fever in the Republic of Colombia. Entomol. Soc. Wash., Proc. 38:57-70.

1956. Notes on mosquitoes from an area of endemic yellow fever in Colombia (Diptera, Culicidae). Entomol. Soc. Wash., Proc. 58:37-42.

Kumm, Henry W.

1931. The geographical distribution of the yellow fever vectors. Am. J. Hyg. Monogr. Ser. 12. 110 p.

Kumm, Henry W., W. H. W. Komp and H. Ruiz

1940. The mosquitoes of Costa Rica. Am. J. Trop. Med. 20:385-422.

Kumm, Henry W. and H. Zuniga

1942. The mosquitoes of El Salvador. Am. J. Trop. Med. 22:399-415.

Laffoon, Jean L. and K. L. Knight

1971. A mosquito taxonomic glossary. VI. Female genitalia. Mosq. Syst. Newsl. 3:32-41.

Lane, John

1939. Catalogo dos mosquitos neotropicos. Bol. Biol., Ser. Monogr. 1. 218 p.

1951. Synonymy of Neotropical Culicidae (Diptera). Entomol. Soc. Wash., Proc. 53:333-336.

1953. Neotropical Culicidae. Vol. 2. Sao Paulo, Univ. Sao Paulo. p. 553-1112.

Levi-Castillo, Roberto

1951. Nota taxonomica sobre la especie Ecuatoriana *Aedes (Ochlerotatus) camposanus* Dyar 1918 (Dipt. Culicidae). Rev. Entomol. 22:383-387.

1952. Redescription of *Aedes (Ochlerotatus) camposanus* Dyar (1918) as a valid species found in the coastal plain of Ecuador. Pac. Sci. 6:262-264.

Lewis, A. L., W. McD. Hammon, G. E. Sather, D. J. Taylor and J. O. Bond

1965. Isolations of a California group arbovirus from Florida mosquitoes. Am. J. Trop. Med. Hyg. 14:451-455.

Lima, Angelo da Costa

1933. Sobre um novo *Aedes (Ochlerotatus)* do Brasil. Inst. Oswaldo Cruz, Mem. 27:403-407.

Lutz, Adolpho

1904a. Catalogo dos culicideos Brasileiros e Sul-Americanos. In Bourroul, Celestino. Mosquitos do Brasil. Bahia. 16 p.

1904b. Chave para a determinacao das especies da subfamilia Culicinae. In Bourroul, Celestino. Mosquitos do Brasil. Bahia. 5 p.

Lutz, Adolpho and M. Nunez Tovar

1928. Contribuicion para el estudio de los dipteros hematofagos de Venezuela, por los doctores Adolpho Lutz y Nunez Tovar. In Lutz, Adolpho. Estudios de zoologia y parasitologia venezolanas. Rio de Janeiro. p. 7-38.



Lutz, Adolpho, H. C. de Souza Araujo and O. da Fonseca Filho

1919. Report on the journey down the river Parana to Assuncion and the return journey over Buenos Aires, Montevideo and Rio Grande. Inst. Oswaldo Cruz, Mem. 10:83-87.

Lynch Arribalzaga, Felix

1891. Dipterologia Argentina. Mus. La Plata, Rev. 2:131-174.

Maldonado-Capriles, J., W. F. Pippin and M. L. Kuns

1958. An annotated check list of the mosquitoes of Mona Island, Puerto Rico, and the larva and male of *Aedes obturbator* D. & K. (Diptera, Culicidae). Entomol. Soc. Wash., Proc. 60:65-68.

Martinez, Antonio and A. F. Prosen

1953. Una nueva especie de mosquito de la Argentina. Mision Estud. Patol. Reg. Argent., Folia 1. 2 p.

Martini, Erich C. W.

1931a. Die ausbeute der deutschen Chaco-Expedition 1925/1926. Diptera. XXV. Culicidae. Konowia, Vienna 10:116-120.

1931b. Ueber einige sudamerikanische Culiciden. Rev. Entomol. 1:199-219.

1935. Los mosquitos de Mexico. Mexico, Dep. Salubr. Publica, Bol. Tec. (A) 1. 65 p.

Matheson, Robert

1944. Handbook of the mosquitoes of North America. Ed. 2. Ithaca, Comstock Pub. Co. 314 p.

Mattos, Synezio and S. H. Xavier

1965. Distribucao geografica dos culicineos do Brasil (Diptera, Culicidae). I—Estado de Goias. Rev. Bras. Malariol. Doencas Trop. 17:269-291.

Mayr, Ernst

1973. Animal species and evolution. Camb., Mass., Harv. Univ. Press. 797 p.

McGregor, Theodore and R. B. Eads

1943. Mosquitoes of Texas. J. Econ. Entomol. 36:938-940.

Miller, Bryan G., J. M. Doll and J. R. Wheeler

1964. New records of New Mexico mosquitoes. Mosq. News 24:459-460.

Montchadsky, Alexander S. and I. Garcia Avila

1966. Las larvas de los mosquitos (Diptera:Culicidae) de Cuba. Su biologia y determinacion. Poeyana (A) 28. 92 p.

Morales-Ayala, Francisco

1971. A list of the mosquitoes of Peru (Diptera, Culicidae). Mosq. Syst. Newsl. 3:138-145.

Papavero, Nelson

1971-1973. Essays on the history of neotropical dipterology, with special reference to collectors (1750-1905). Sao Paulo, Univ. Sao Paulo. 2 vol.

Pazos, Jose H.

1908. Descripcion de nuevas especies de mosquitos de Cuba. Acad. Cienc. (Cienc. Med. Fis. Nat.) Habana, An. 45:417-432.

Perez Vigueras, Ildefonso

1956. Los ixodidos y culicidos de Cuba. Su historia natural y medica. La Habana. 579 p.

Porter, John E.

1967. A check list of the mosquitoes of the Greater Antilles and the Bahama and Virgin Islands. Mosq. News 27:35-41.



Prado, Alcides

1931. Contribuicoes ao conhecimento dos culicideos de Sao Paulo. II. Notas sobre as especies encontradas nos arredores da capital e sobre a determinacao de *Aedes crinifer* (Theob.). Inst. Butantan, Mem. 6:199-203.

Price, Roger D.

1960. Identification of first-instar aedine mosquito larvae of Minnesota (Diptera: Culicidae). Can. Entomol. 92:544-560.

Pritchard, A. Earl, E. L. Seabrook and J. A. Mulrennan

1947. The mosquitoes of the Florida Keys. Fla. Entomol. 30:8-15.

Prosen, Alberto F., R. U. Carcavallo and A. Martinez

1964. Culicidae de Bolivia. Inst. Med. Reg., An. 6:59-124.

Rachou, Rene G., M. Moura Lima, J. A. Ferreira Neto and C. M. Martins

1954. *Aedes scapularis*, novo transmissor comprovado da filariose bancroftiana no sul de Brasil (nota previa). Rev. Bras. Malariol. Doencas Trop. 6:145.

1955. Inquerito epidemiologico de filariose bancroftiana em uma localidade de Santa Catarina, como fase preliminar de uma prova profilatica. Constatacao de transmissao extradomiciliaria por um novo vetor, *Aedes scapularis*. Rev. Bras. Malariol. Doencas Trop. 7:51-70.

1958. Alguns dados sobre o comportamento de mosquitos de Ponta Grossa (Florianopolis, Santa Catarina). Rev. Bras. Malariol. Doencas Trop. 10:417-427.

Reinert, John F.

1970. Description of the pupa of *Aedes (Ochlerotatus) infirmatus* (Diptera: Culicidae). Fla. Entomol. 53:148-149.

Rigby, Paul T.

1968. Occurrence of *Aedes infirmatus* D. & K. in Arizona. Mosq. News 28:239-240.

de Rodaniche, Enid and P. Galindo

1963. Ecological observations on Ilheus virus in the vicinity of Almirante, Republic of Panama. Am. J. Trop. Med. Hyg. 12:924-928.

Rondani, Camillo

1848. Ditteri Brasiliani. Studi Entomol. 1:108-110.

Ronderos, Ricardo A. and M. Garcia

- 1963a. Descripcion de pupas de *Aedes* Argentinas (Diptera-Culicidae). Soc. Entomol. Argent. Rev. 25:35-37.

- 1963b. Nota sinonimica en Culicidae (Diptera). Soc. Entomol. Argent., Rev. 25:38.

Root, Francis M.

1922. Notes on mosquitoes and other bloodsucking flies from Porto Rico. Am. J. Hyg. 2:394-405.

1924. Notes on the mosquitoes of Lee County, Georgia. Am. J. Hyg. 4:449-455.

1927. Note on the mosquito fauna of the Republic of Haiti. Am. J. Hyg. 7:463-469.

Root, Francis M. and J. Andrews

1938. Malaria and anopheline survey of Grenada, B. W. I. Am. J. Hyg. 27:549-579.

Ross, Herbert H.

1947. The mosquitoes of Illinois (Diptera, Culicidae). Ill. Nat. Hist. Surv., Bull. 24(1). 96 p.



- Sanmartin, Carlos, R. B. Mackenzie, H. Trapido et al.  
1973. Encefalitis equina Venezolana in Colombia, 1967. Pan Am. Sanit. Bur., Bol. 74:108-137.
- Scherer, William F., R. W. Dickerman, A. Diaz-Najera, B. A. Ward, M. H. Miller and P. A. Schaffer  
1971. Ecologic studies of Venezuelan encephalitis virus in southeastern Mexico. III. Infection of mosquitoes. Am. J. Trop. Med. Hyg. 20:969-979.
- Sellers, R. F., G. H. Bergold, O. M. Suarez and A. Morales  
1965. Investigations during Venezuelan equine encephalitis outbreaks in Venezuela—1962-1964. Am. J. Trop. Med. Hyg. 14:460-469.
- Shannon, Raymond C.  
1931a. The environment and behavior of some Brazilian mosquitoes. Entomol. Soc. Wash., Proc. 33:1-27.  
1931b. On the classification of Brazilian Culicidae with special reference to those capable of harboring the yellow fever virus. Entomol. Soc. Wash., Proc. 33:125-164.
- Shannon, Raymond C. and E. Del Ponte  
1928. Los culicidos en la Argentina. Inst. Bacteriol. Malbran, B. Aires, Rev. 5:29-140.
- Shannon, Raymond C., L. Whitman and M. Franca  
1938. Yellow fever virus in jungle mosquitoes. Science 88:110-111.
- Shlaifer, Arthur and D. E. Harding  
1946. The mosquitoes of Tennessee. Tenn. Acad. Sci., J. 21:241-256.
- Soper, F. L., H. Penna, E. Cardoso, J. Serafim, Jr., M. Frobisher, Jr. and J. Pinheiro  
1933. Yellow fever without *Aedes aegypti*. Study of a rural epidemic in the Valle do Chanaan, Espirito Santo, Brazil, 1932. Am. J. Hyg. 18:555-587.
- Spence, Leslie, C. R. Anderson, T. H. G. Aitken and W. G. Downs  
1962. Melao virus, a new agent isolated from Trinidadian mosquitoes. Am. J. Trop. Med. Hyg. 11:687-690.
- Staebler, Arthur G. and W. P. Buren  
1946. *Aedes tortilis* (Theobald), a mosquito new to the United States. Public Health Rep. 61:685.
- Steward, C. C. and J. W. McWade  
1960. The mosquitoes of Ontario (Diptera:Culicidae) with keys to the species and notes on distribution. Entomol. Soc. Ont., Proc. 91:121-188.
- Stone, Alan  
1967. A synoptic catalog of the mosquitoes of the world, supplement III (Diptera:Culicidae). Entomol. Soc. Wash., Proc. 69:197-224.  
1969. Bredin-Archbold-Smithsonian biological survey of Dominica: The mosquitoes of Dominica (Diptera:Culicidae). Smithson. Contrib. Zool. 16. 8 p.
- Stone, Alan and K. L. Knight  
1956. Type specimens of mosquitoes in the United States National Museum: II, The genus *Aedes* (Diptera, Culicidae). Wash. Acad. Sci., J. 46:213-228.
- Stone, Alan, K. L. Knight and H. Starcke  
1959. A synoptic catalog of the mosquitoes of the world (Diptera, Culicidae). Wash., Entomol. Soc. Am. (Thomas Say Found., vol. 6). 358 p.
- Sudia, W. Daniel, R. W. Chamberlain and P. H. Coleman  
1968. Arbovirus isolations from mosquitoes collected in south Alabama, 1959-1963, and serologic evidence of human infection. Am. J. Trop. Med. Hyg. 87:112-126.



- Sudia, W. Daniel, L. Fernandez, V. F. Newhouse, R. Sanz B. and C. H. Calisher  
1975. Arbovirus vector studies in Mexico during the 1972 Venezuelan equine encephalitis outbreak. *Am. J. Epidemiol.* 101:51-58.
- Sudia, W. Daniel and V. F. Newhouse  
1975. Epidemic Venezuelan equine encephalitis in North America: A summary of virus-vector-host relationships. *Am. J. Epidemiol.* 101:1-13.
- Sudia, W. Daniel, V. F. Newhouse, L. D. Beadle, D. L. Miller, J. G. Johnston, Jr., R. Young, C. H. Calisher and K. Maness  
1975. Epidemic Venezuelan equine encephalitis in North America in 1971: Vector studies. *Am. J. Epidemiol.* 101:17-35.
- Sudia, W. Daniel, V. F. Newhouse, C. H. Calisher and R. W. Chamberlain  
1971. California group arboviruses: isolations from mosquitoes in North America. *Mosq. News* 31:576-600.
- Sudia, W. Daniel, V. F. Newhouse and W. A. Chappell  
1969. Venezuelan equine encephalitis virus-vector studies following a human case in Dade County, Florida, 1968. *Mosq. News* 29:596-600.
- Surcouf, Jacques M. R. and R. Gonzalez-Rincones  
1911. Essai sur les dipteres vulnerants du Venezuela. Premiere partie. Dipteres nematoceres vulnerants. Paris, Maloine. 320 p.
- Taylor, D. J., A. L. Lewis, J. D. Edman and W. L. Jennings  
1971. California group arboviruses in Florida. Host-vector relations. *Am. J. Trop. Med. Hyg.* 20:139-145.
- Theobald, Frederick V.  
1901. A monograph of the Culicidae or mosquitoes. Vol. 2. Lond., Br. Mus. (Nat. Hist.). 391 p.  
1903a. A monograph of the Culicidae or mosquitoes. Vol. 3. Lond., Br. Mus. (Nat. Hist.). 359 p.  
1903b. Two new Jamaican Culicidae. *Entomol.* 36:281-283.  
1905. Diptera. Fam. Culicidae. *Genera Insectorum* 26. 50 p.  
1907. A monograph of the Culicidae or mosquitoes. Vol. 4. Lond., Br. Mus. (Nat. Hist.). 639 p.  
1910. A monograph of the Culicidae or mosquitoes. Vol. 5. Lond., Br. Mus. (Nat. Hist.). 646 p.
- Theobald, Frederick V. and M. Grabham  
1905. The mosquitoes or Culicidae of Jamaica. Kingston, Inst. Jam. 40 p.
- Thurman, Ernestine B., J. S. Haeger and J. A. Mulrennan  
1949. The occurrence of *Aedes (Ochlerotatus) thelcter* Dyar in the Florida Keys. *Mosq. News* 9:171-173.
- Torre y Callejas, S. L. de la, P. Alayo Delmau and M. Calderon Chapman  
1961. Los mosquitos de Cuba. *Soc. Cubana Hist. Nat., Mem.* 25(2). 95 p.
- Trimble, R. M.  
1972. Occurrence of *Culiseta minnesotae* and *Aedes trivittatus* (Diptera: Culicidae) in Manitoba including a list of mosquitoes from Manitoba. *Can. Entomol.* 104:1535-1537.
- Vargas, Luis  
1956. Especies y distribucion de mosquitos mexicanos no anofelinos. *Inst. Salubridad y Enfermedades Trop., Rev.* 16:20-36.
- Weathersbee, Albert A. and F. T. Arnold, Jr.  
1947. A resume of the mosquitoes of South Carolina. *Tenn. Acad. Sci., J.* 22: 210-229.



Wellings, F. M., A. L. Lewis and L. V. Pierce

1972. Agents encountered during arboviral ecological studies: Tampa Bay area, Florida, 1963 to 1970. *Am. J. Trop. Med. Hyg.* 21:201-213.

Whitman, Loring and P. C. A. Antunes

1937. Studies on the capacity of various Brazilian mosquitoes, representing the genera *Psorophora*, *Aedes*, *Mansonia* and *Culex*, to transmit yellow fever. *Am. J. Trop. Med.* 17:803-823.

Willis, William, V. Pidcoe, D. F. Carroll and J. E. Satz

1974. Isolation of California group arboviruses from Pennsylvania mosquitoes—1971, 1972. *Mosq. News* 34:376-381.

Wong, Y. W., D. C. Dorsey, M. J. Humphreys and W. J. Hausler, Jr.

1970. Arbovirus encephalitis surveillance in Iowa. *Health Lab. Sci.* 1970:117-123.

Wong, Y. W., W. A. Rowley, J. A. Rowe, D. C. Dorsey, M. J. Humphreys and W. J. Hausler, Jr.

1973. California encephalitis studies in Iowa during 1969, 1970 and 1971. *Health Lab. Sci.* 10:88-95.

Xavier, Sebastiao H. and S. S. Mattos

1970. Distribucao geografica dos culicineos no Brasil (Diptera, Culicidae). II.—Estado de Mato Grosso. *Rev. Bras. Malariol. Doencas Trop.* 22:441-460.

## FIGURES

1. Distribution of *Incomptus*, *Bogotanus*, *Tortilis*, *Pectinatus* and *Thelcter* Subgroups and Surinam form
2. Distribution of *Trivittatus*, *Crinifer* and *Obturbator* Subgroups
3. Distribution of *Infirmatus* Subgroup
4. Distribution of *Scapularis* Subgroup
5. *Aedes (O.) incomptus*; male and female head and claws; male foretarsus 5; female thorax, wing, legs and genitalia
6. *Aedes (O.) incomptus*; male and female scutum; male genitalia, pupa
7. *Aedes (O.) incomptus*; larva
8. *Aedes (O.) bogotanus*; male and female head and claws; male foretarsus 5; female thorax, wing, legs and genitalia
9. *Aedes (O.) bogotanus*; male and female scutum; male genitalia, pupa
10. *Aedes (O.) bogotanus*; larva
11. *Aedes (O.) deficiens*; female scutum, pupa
12. *Aedes (O.) deficiens*; larva
13. *Aedes (O.) atactavittatus*; male and female scutum; male genitalia, pupa
14. *Aedes (O.) atactavittatus*; larva
15. *Aedes (O.) angustivittatus*; male and female scutum; male genitalia, pupa
16. *Aedes (O.) angustivittatus*; larva
17. *Aedes (O.) trivittatus*; male and female head and claws; male foretarsus 5; female thorax, wing, legs and genitalia
18. *Aedes (O.) trivittatus*; male and female scutum; male genitalia, pupa
19. *Aedes (O.) trivittatus*; larva
20. *Aedes (O.) tortilis*; male and female head and claws; male foretarsus 5; female thorax, wing, legs and genitalia
21. *Aedes (O.) tortilis*; male and female scutum; male genitalia, pupa



22. *Aedes (O.) tortilis*; larva
23. *Aedes (O.) auratus*; larva
24. *Aedes (O.) auratus*; male genitalia; *Aedes (O.) condolescens*; male and female scutum; male genitalia
25. *Aedes (O.) euplocamus*; male and female scutum; male genitalia, pupa
26. *Aedes (O.) euplocamus*; larva
27. *Aedes (O.) patersoni*; male and female scutum; male genitalia, pupa
28. *Aedes (O.) patersoni*; larva
29. *Aedes (O.) infirmatus*; male and female head and claws; male foretarsus 5; female thorax, wing, legs and genitalia
30. *Aedes (O.) infirmatus*; male and female scutum; male genitalia, pupa
31. *Aedes (O.) infirmatus*; larva
32. *Aedes (O.) meprai* and *Aedes (O.) raymondi*; female scutum; *Aedes (O.) comitatus*; male genitalia
33. *Aedes (O.) phaeonotus*; male and female scutum; male genitalia, pupa
34. *Aedes (O.) phaeonotus*; larva
35. *Aedes (O.) scapularis*; male and female head and claws; male foretarsus 5; female thorax, wing, legs and genitalia
36. *Aedes (O.) scapularis*; male and female scutum; male genitalia, pupa
37. *Aedes (O.) scapularis*; larva
38. *Aedes (O.) crinifer*; male and female head and claws; male foretarsus 5; female thorax, wing, legs and genitalia
39. *Aedes (O.) crinifer*; male and female scutum; male genitalia, pupa
40. *Aedes (O.) crinifer*; larva
41. *Aedes (O.) synchytus* and *Aedes (O.) obturbator*; male and female scutum; male genitalia
42. *Aedes (O.) obturbator*; male and female head and claws; male foretarsus 5; female thorax, wing, legs and genitalia
43. *Aedes (O.) obturbator*; larva
44. *Aedes (O.) pectinatus*; male and female scutum; male genitalia, pupa
45. *Aedes (O.) pectinatus*; larva
46. *Aedes (O.) thelcter*; male and female head and claws; male foretarsus 5; female thorax, wing, legs and genitalia
47. *Aedes (O.) thelcter*; male and female scutum; male genitalia, pupa
48. *Aedes (O.) thelcter*; larva





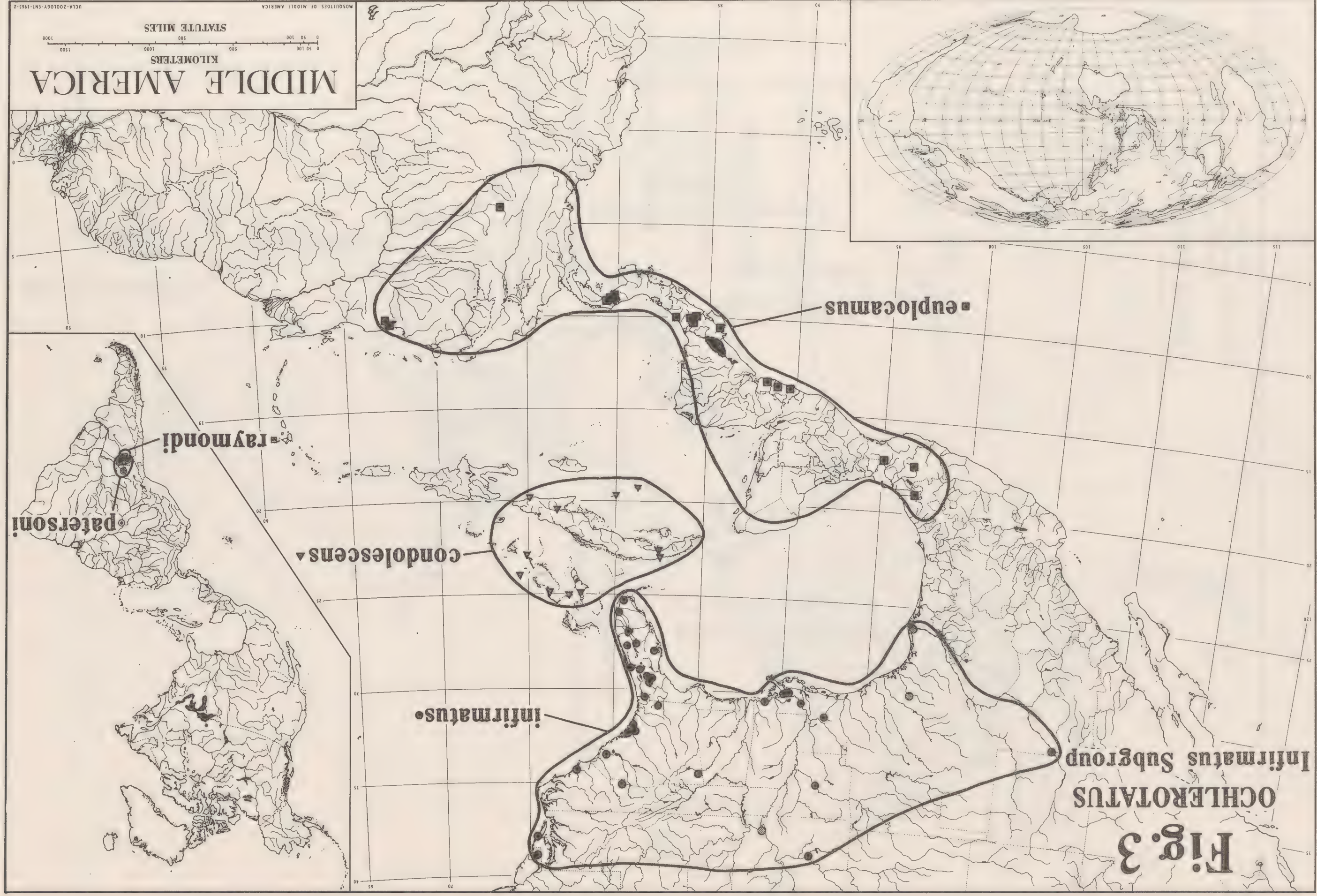


**Fig. 2**

**OCHLEROTATUS**









**Fig. 4**

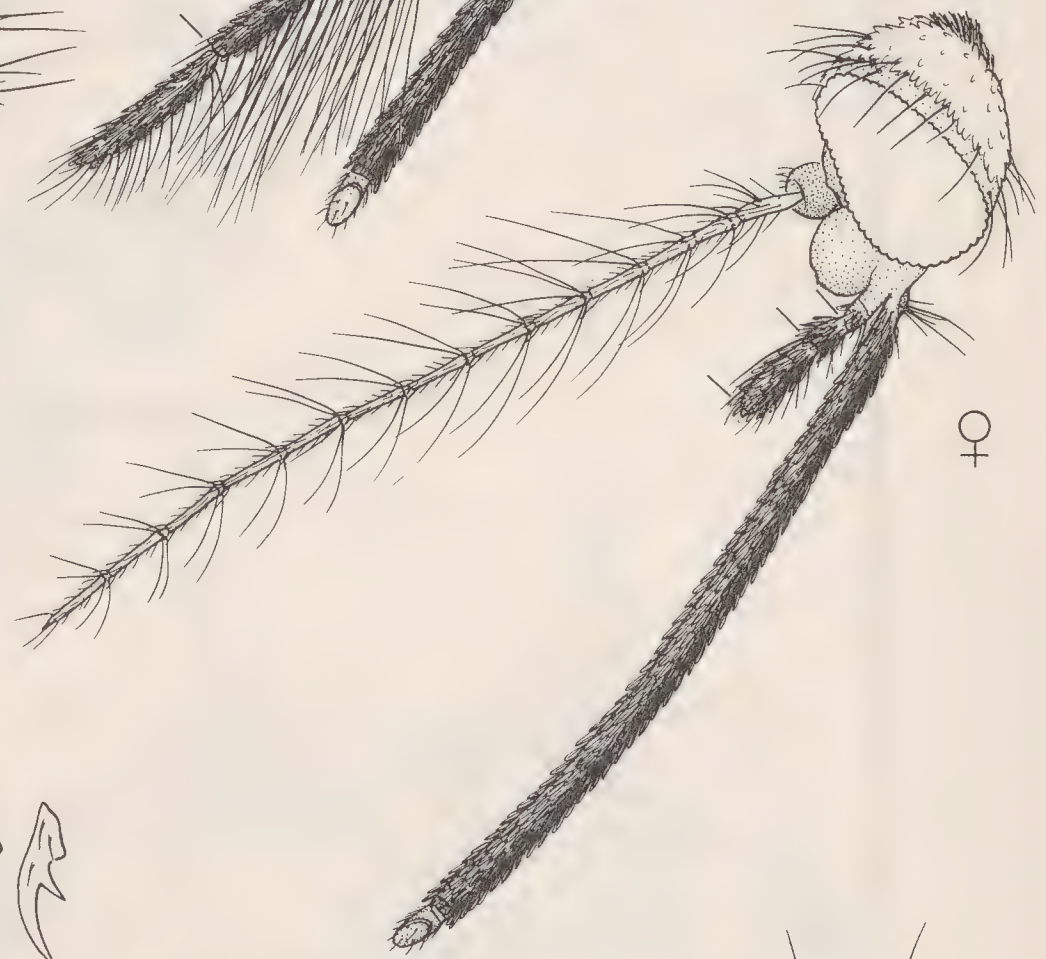
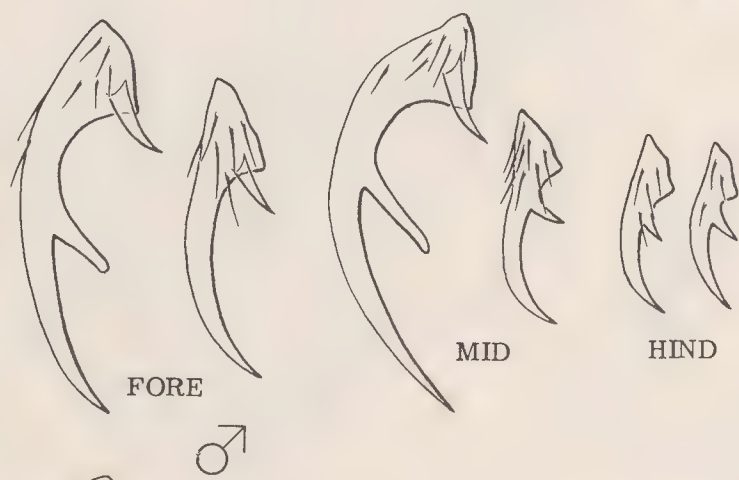
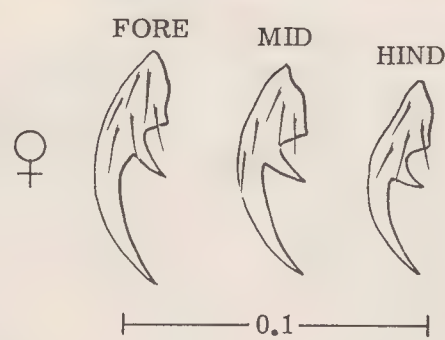
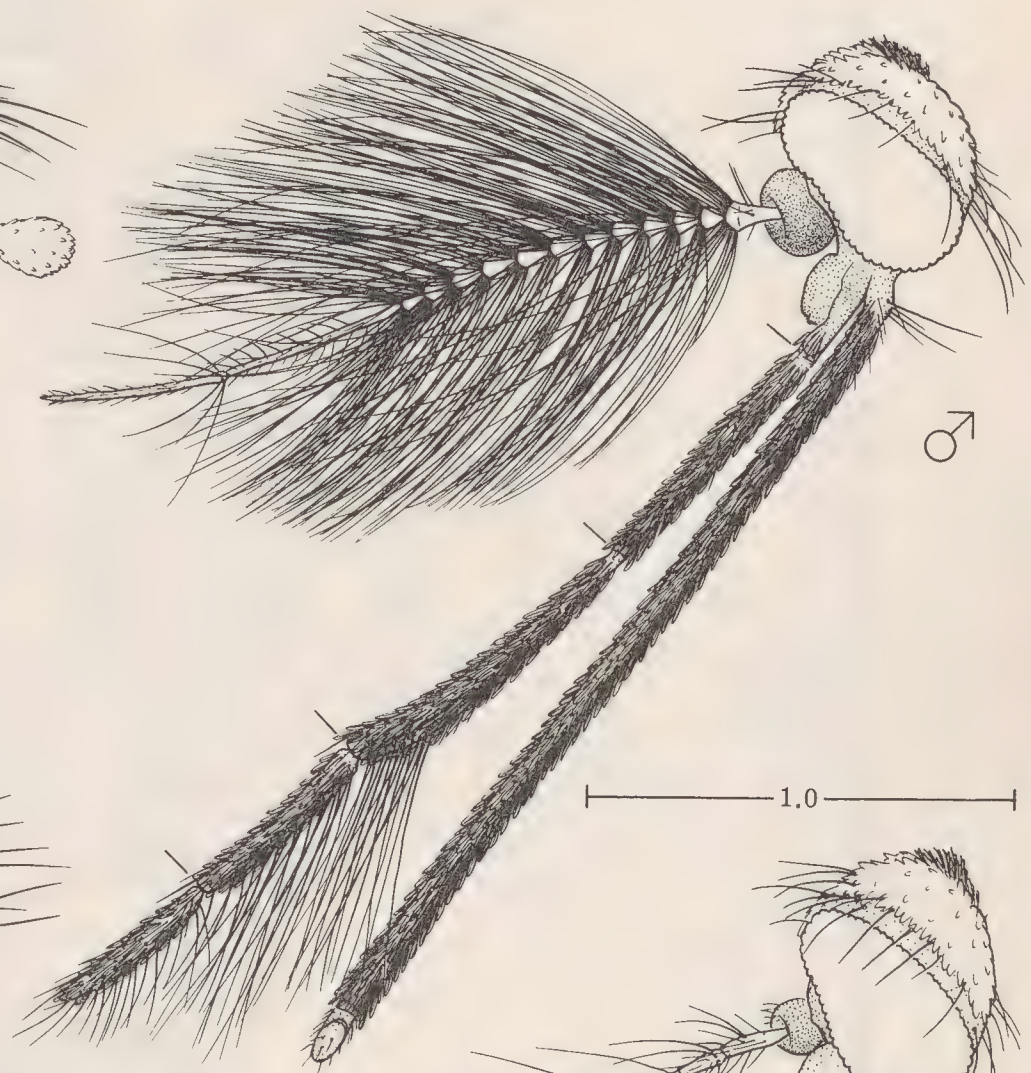
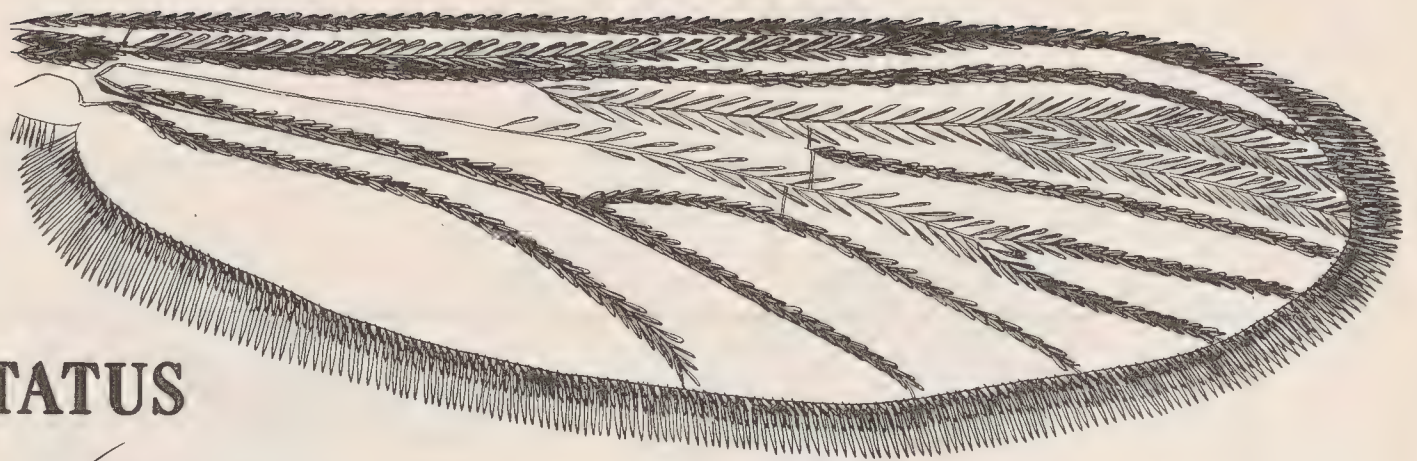
**OCHLEROTATUS**  
**Scapularis Subgroup**





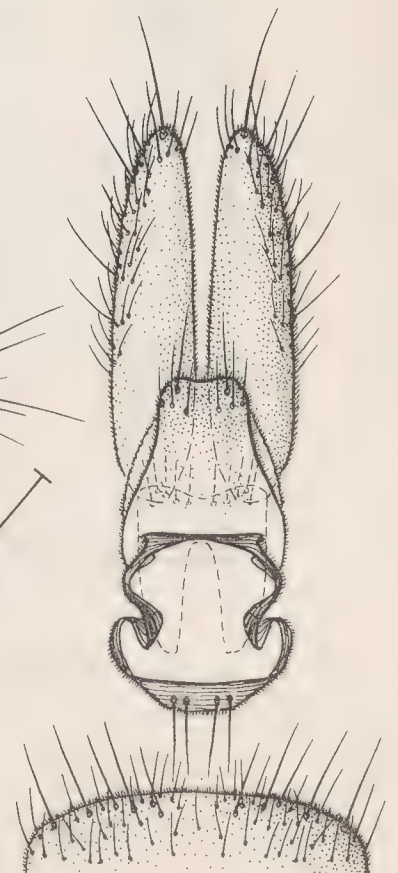
**Fig. 5**

**OCHLEROTATUS**



**incomptus**

PA 379  
Daríen  
Panama





# Fig. 6

## OCHLEROTATUS

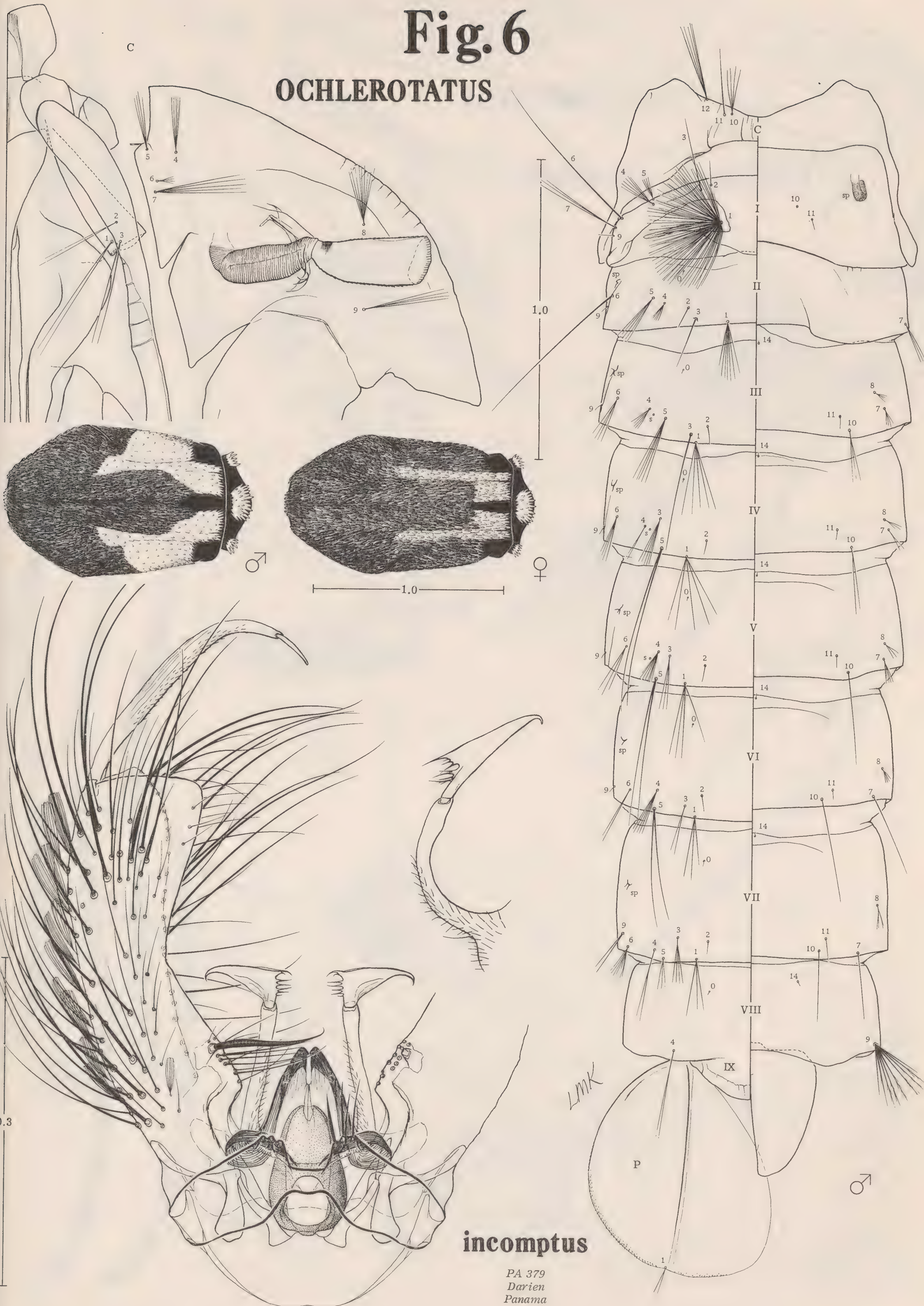
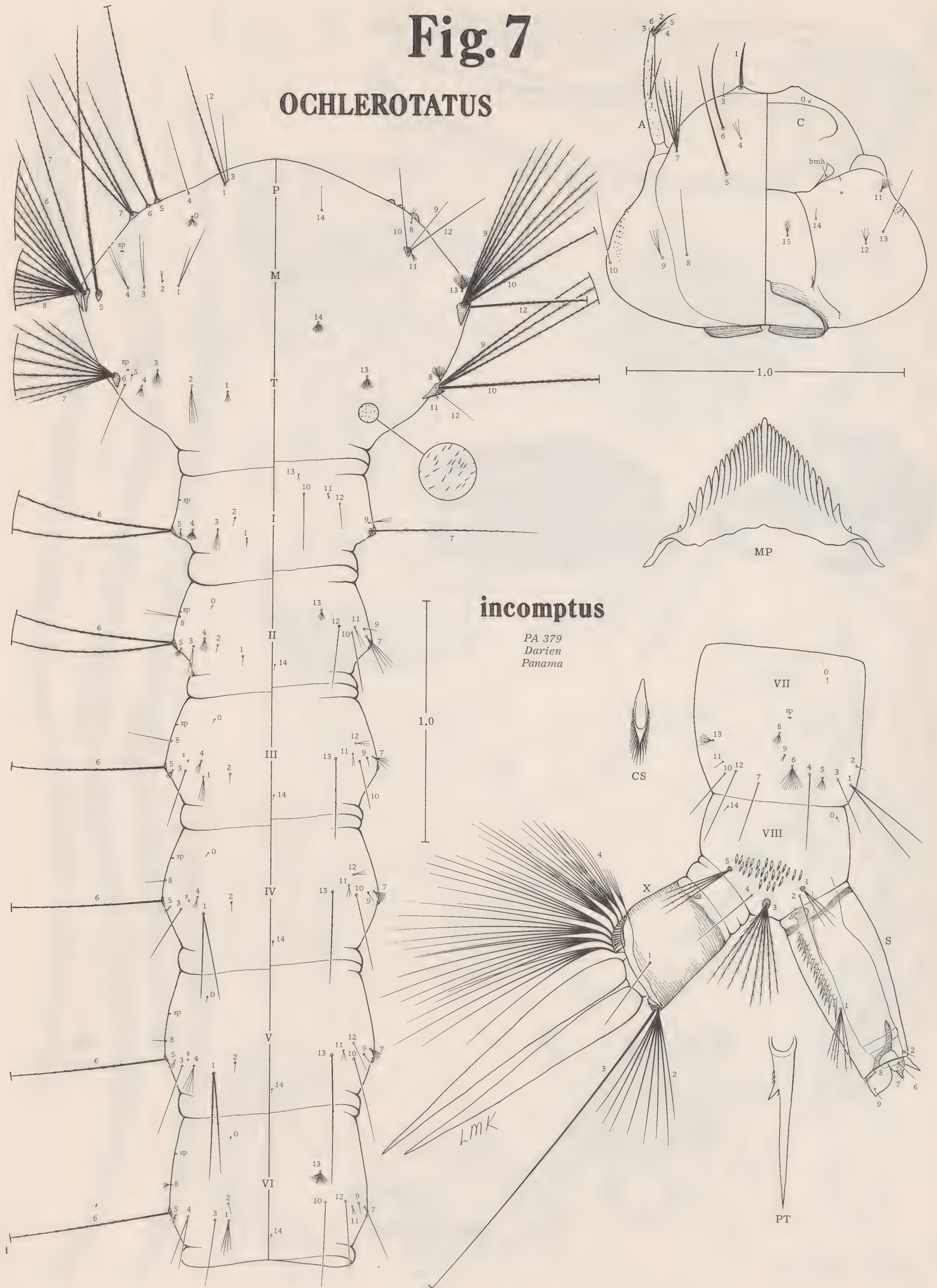




Fig. 7

OCHLEROTATUS

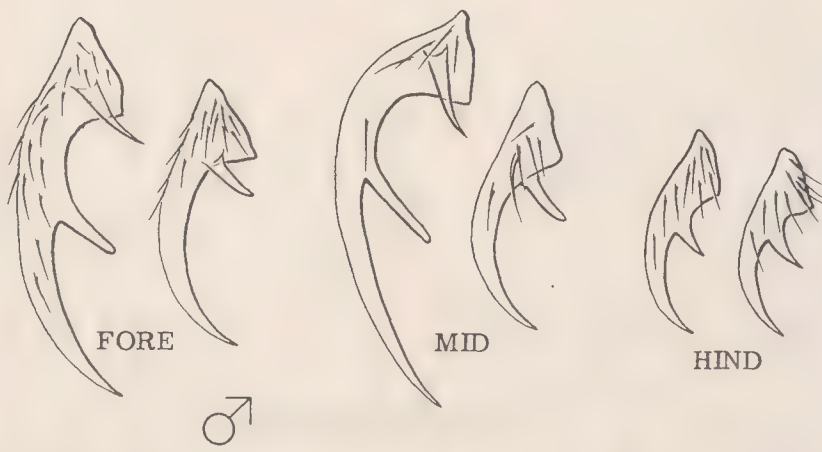
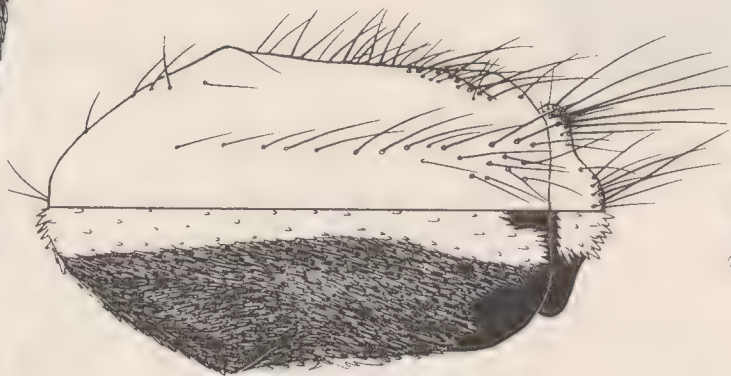
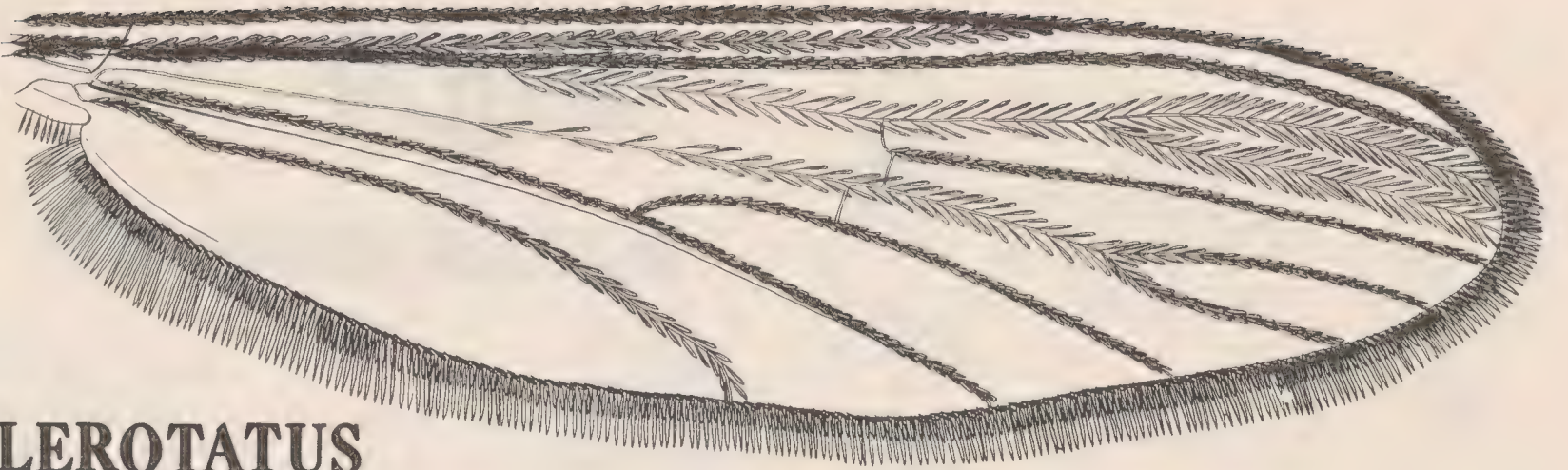






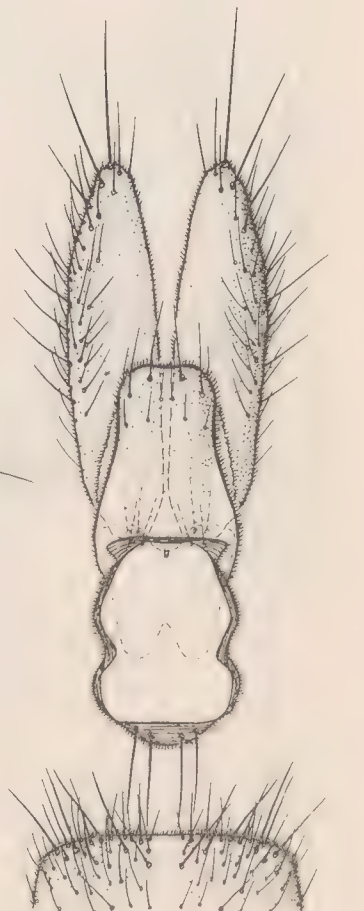
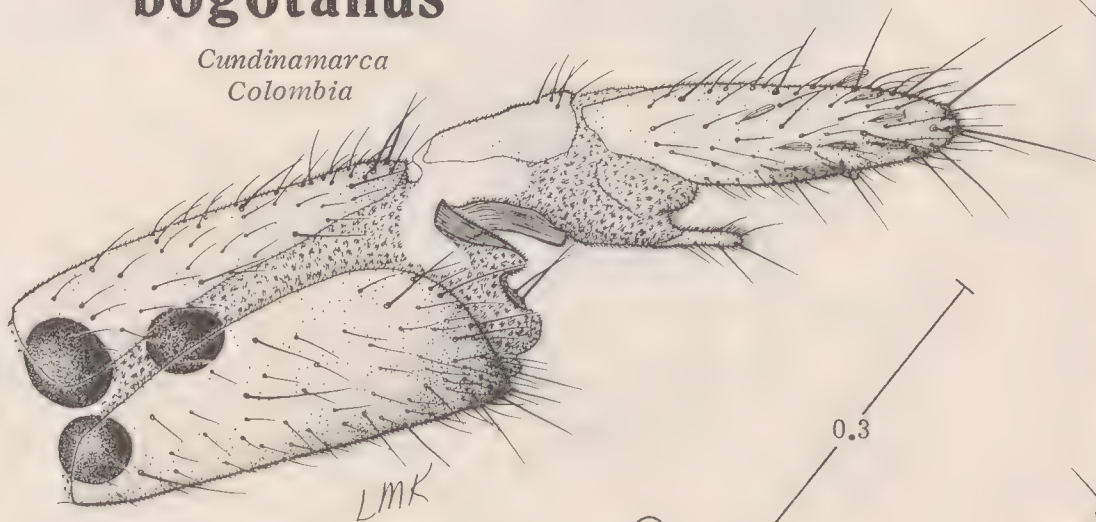
**Fig.  
8**

**OCHLEROTATUS**



**bogotanus**

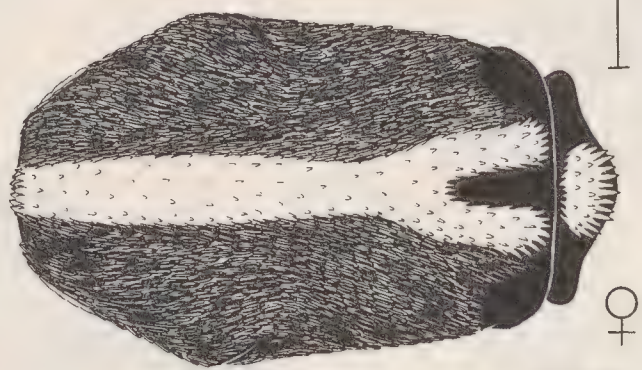
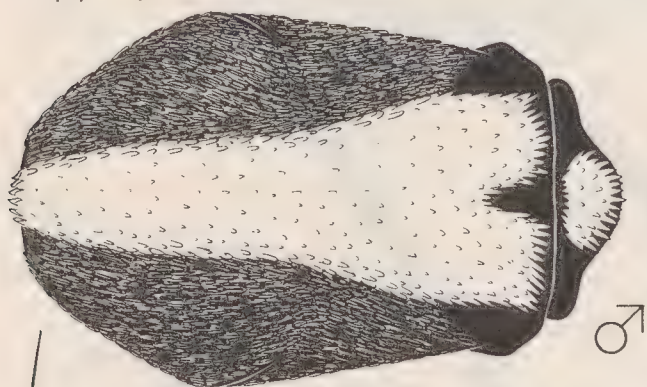
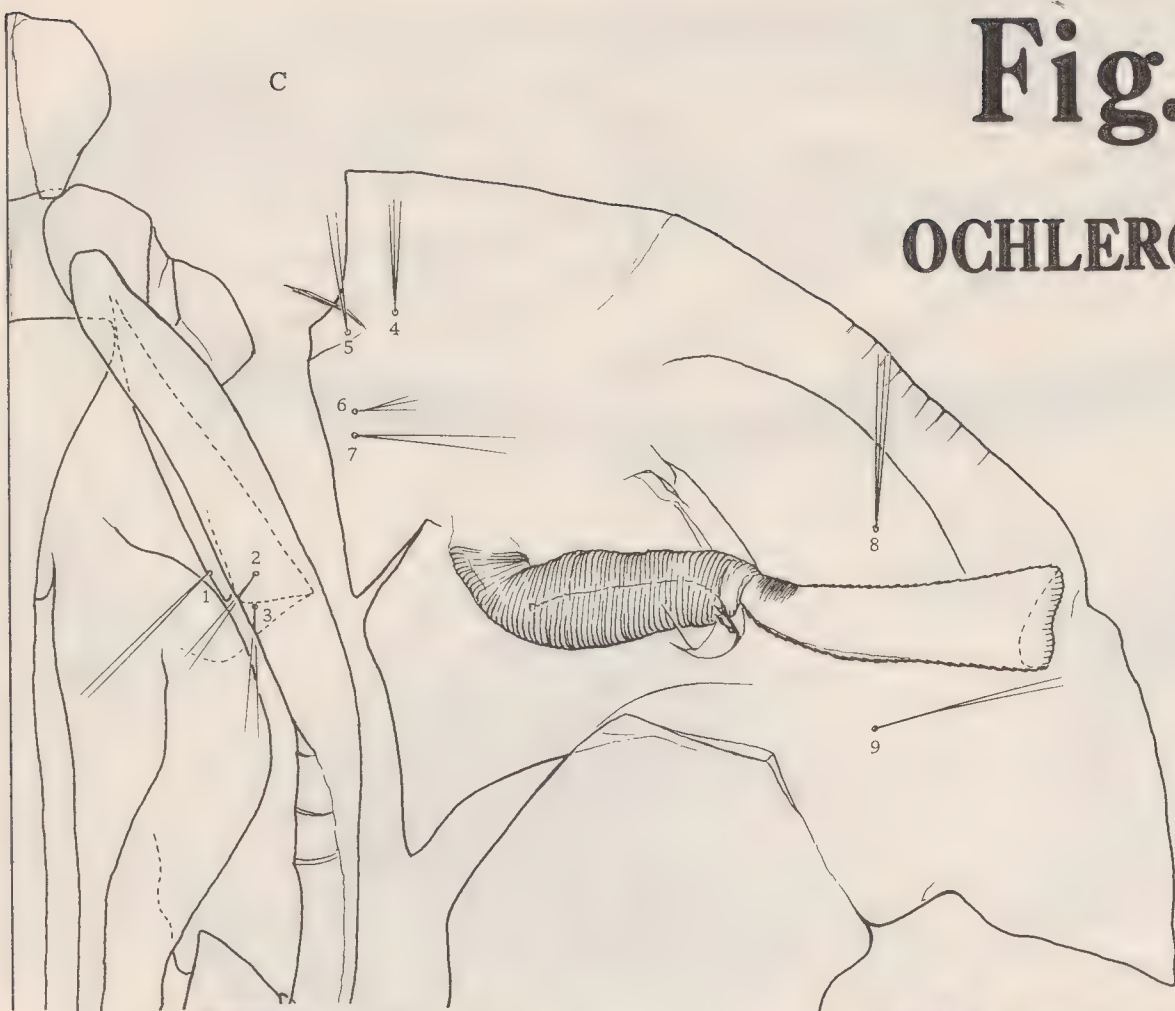
Cundinamarca  
Colombia





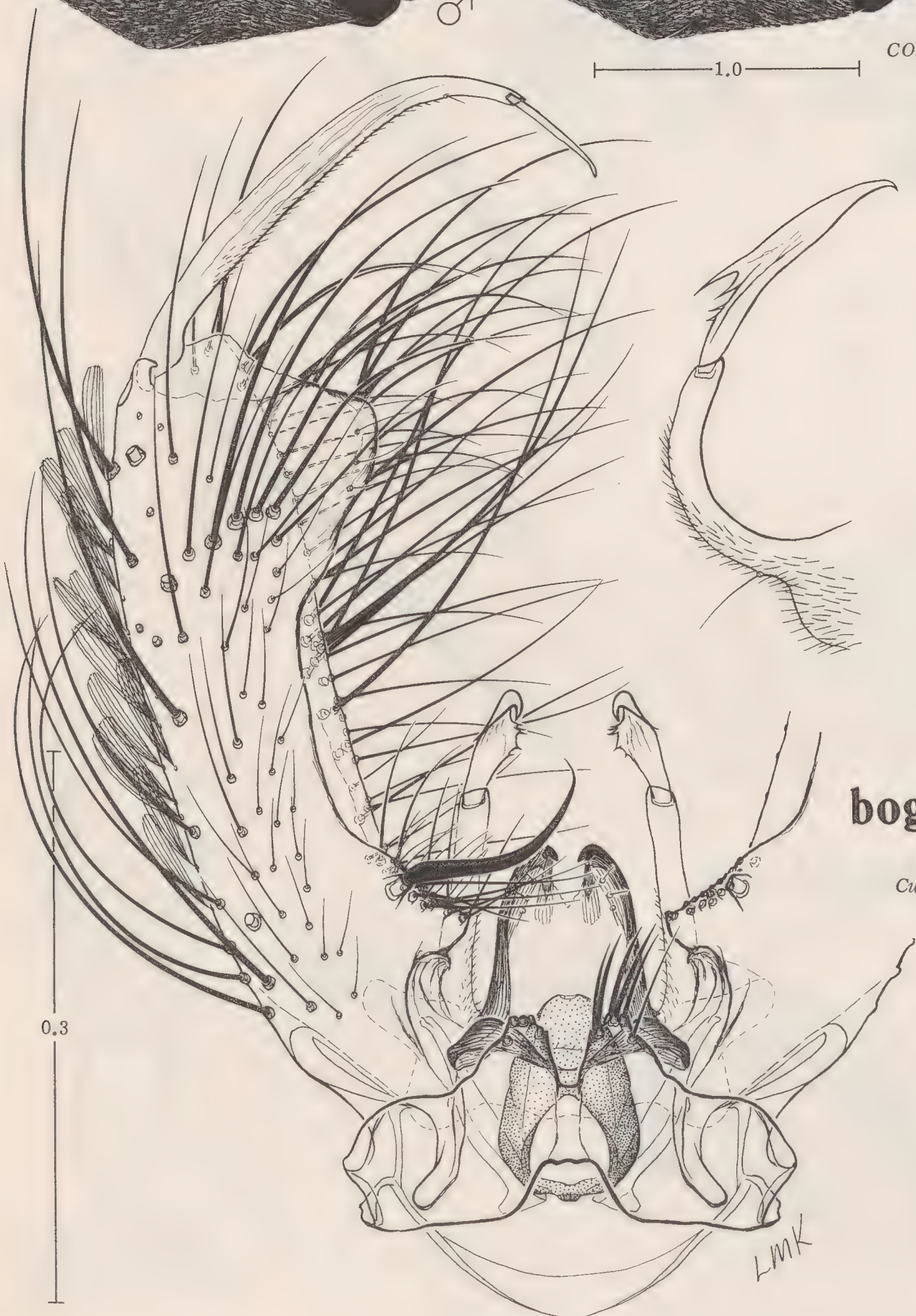
# Fig. 9

## OCHLEROTATUS



COB 96

1.0

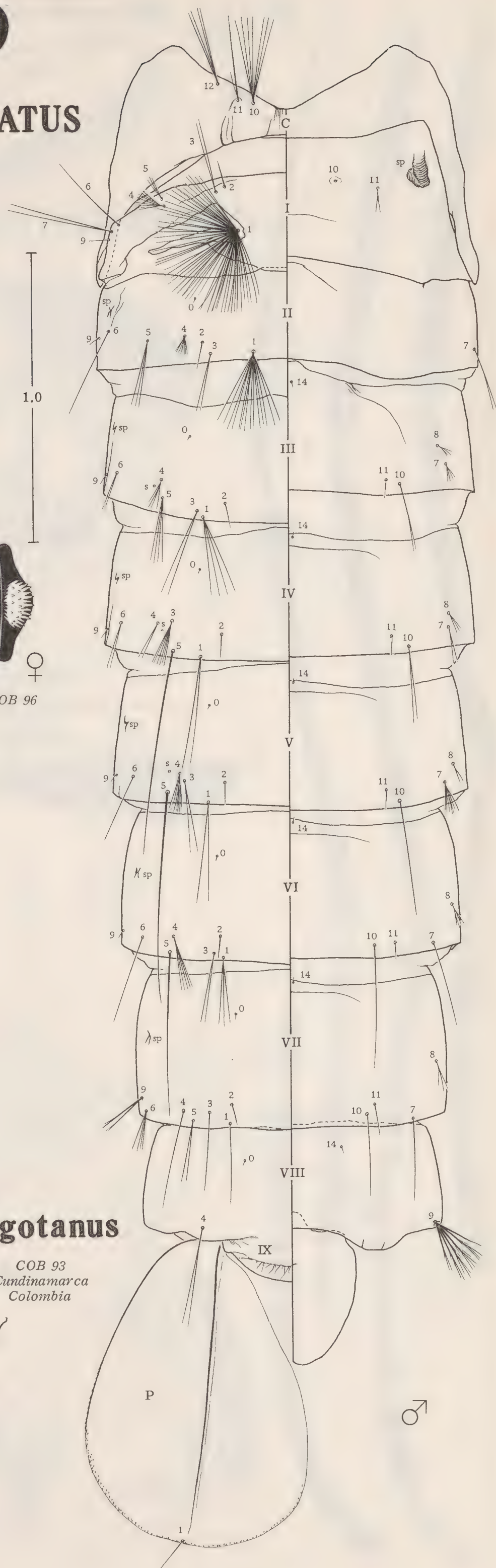


0.3

LMK

**bogotanus**

COB 93  
Cundinamarca  
Colombia



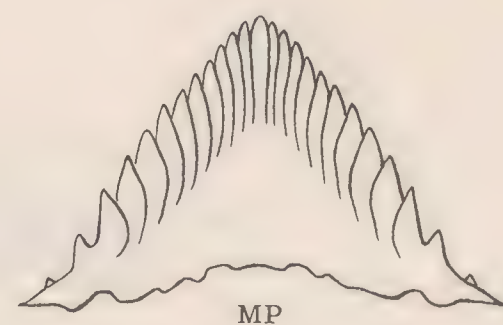
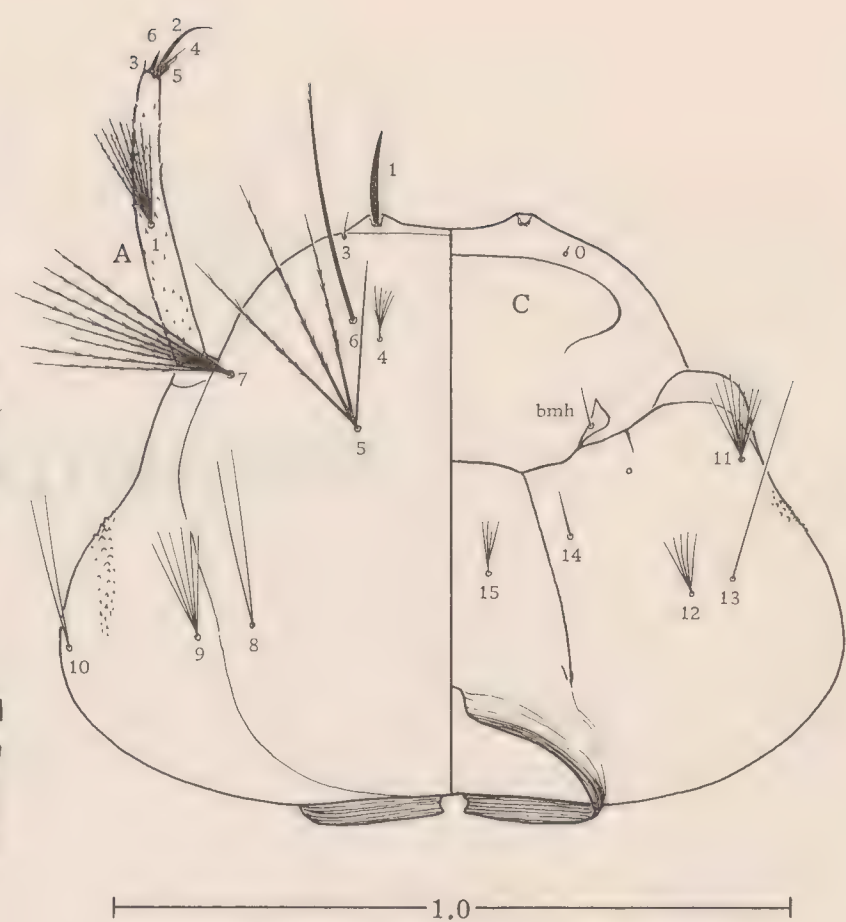
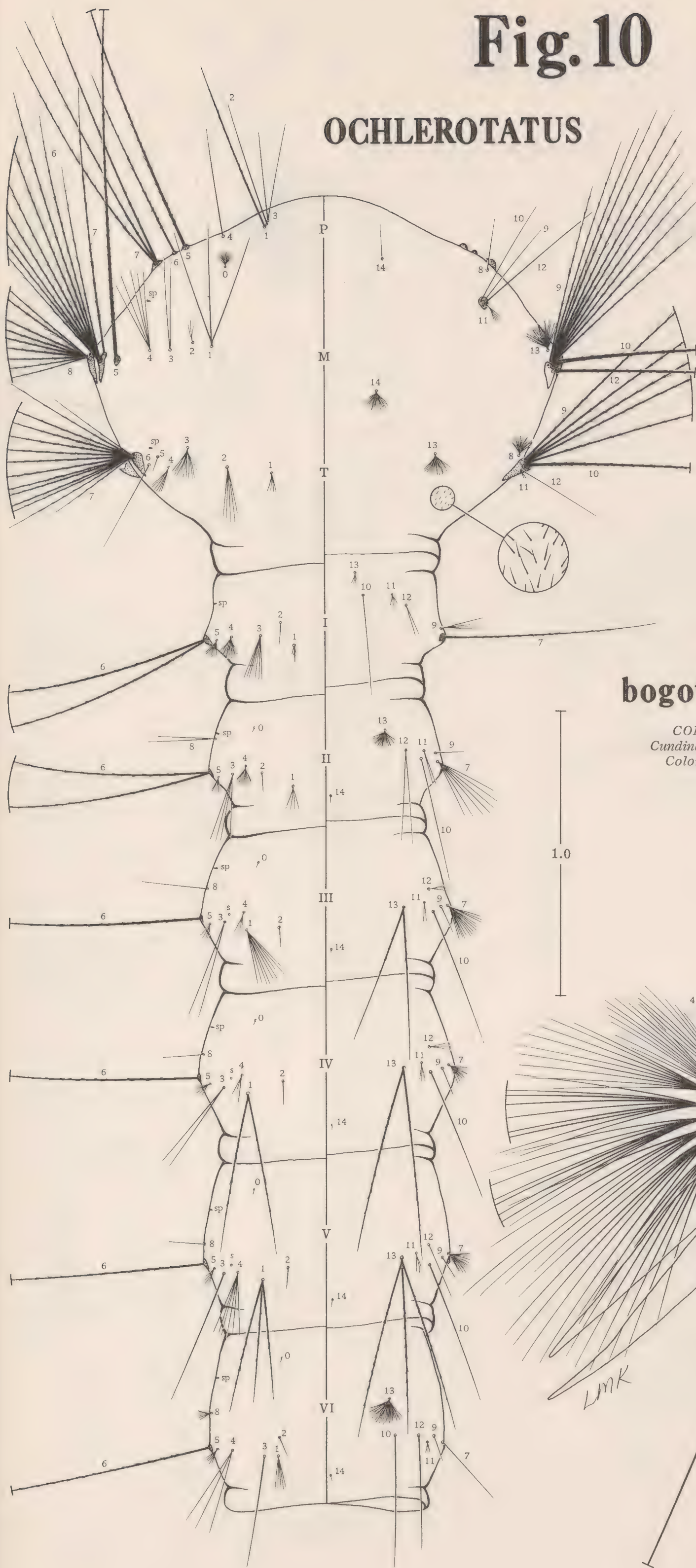
1.0

♂



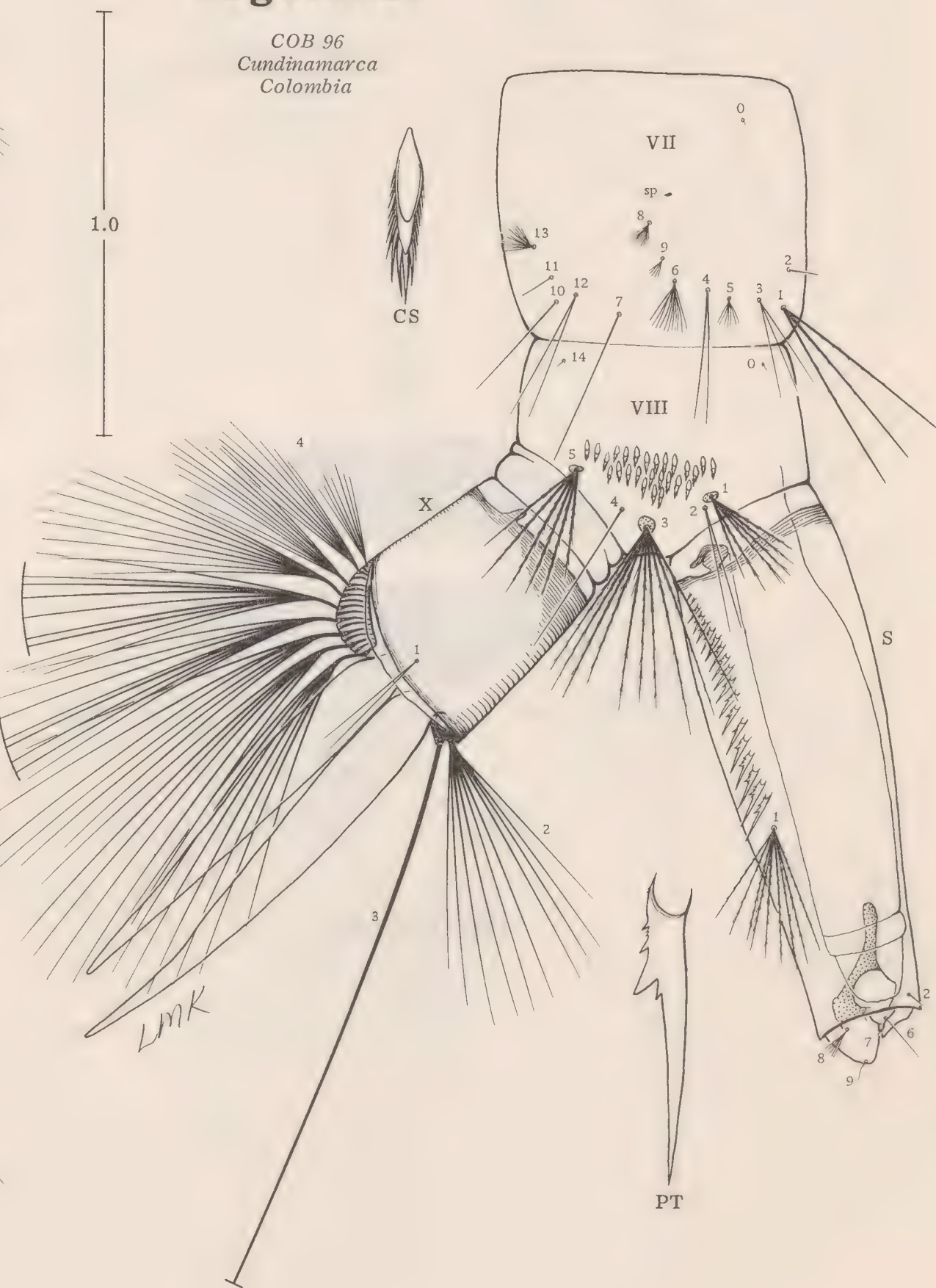
# Fig.10

## OCHLEROTATUS



## bogotanus

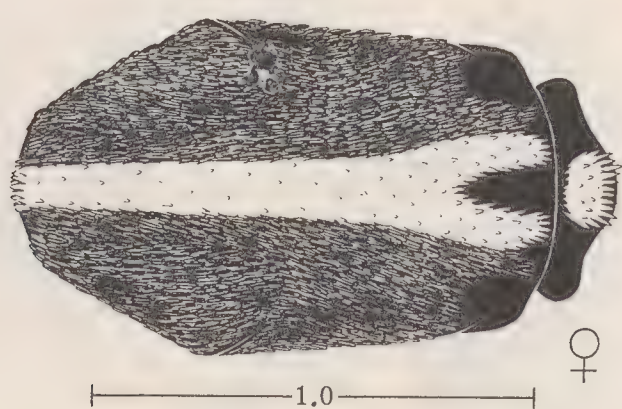
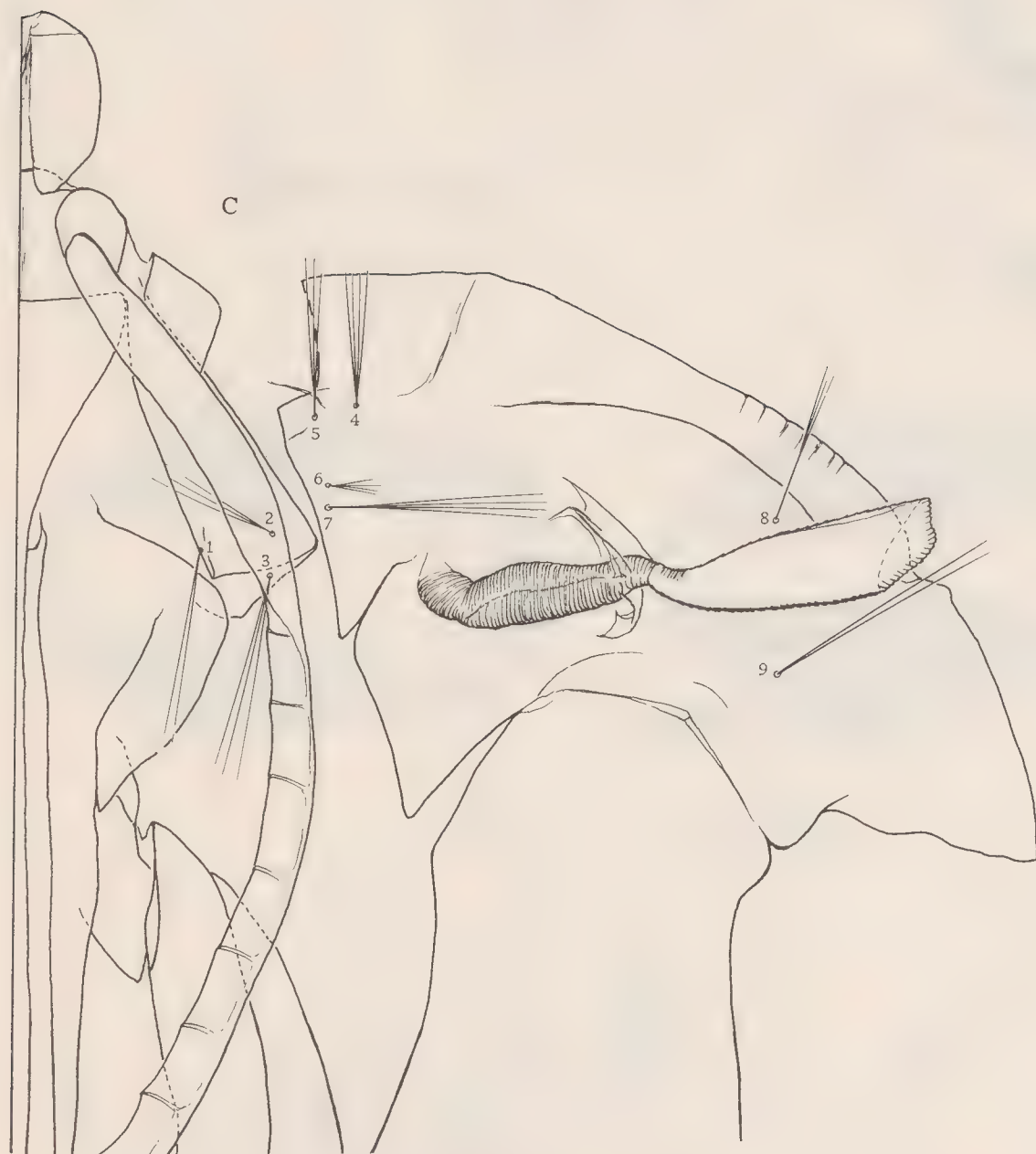
COB 96  
Cundinamarca  
Colombia





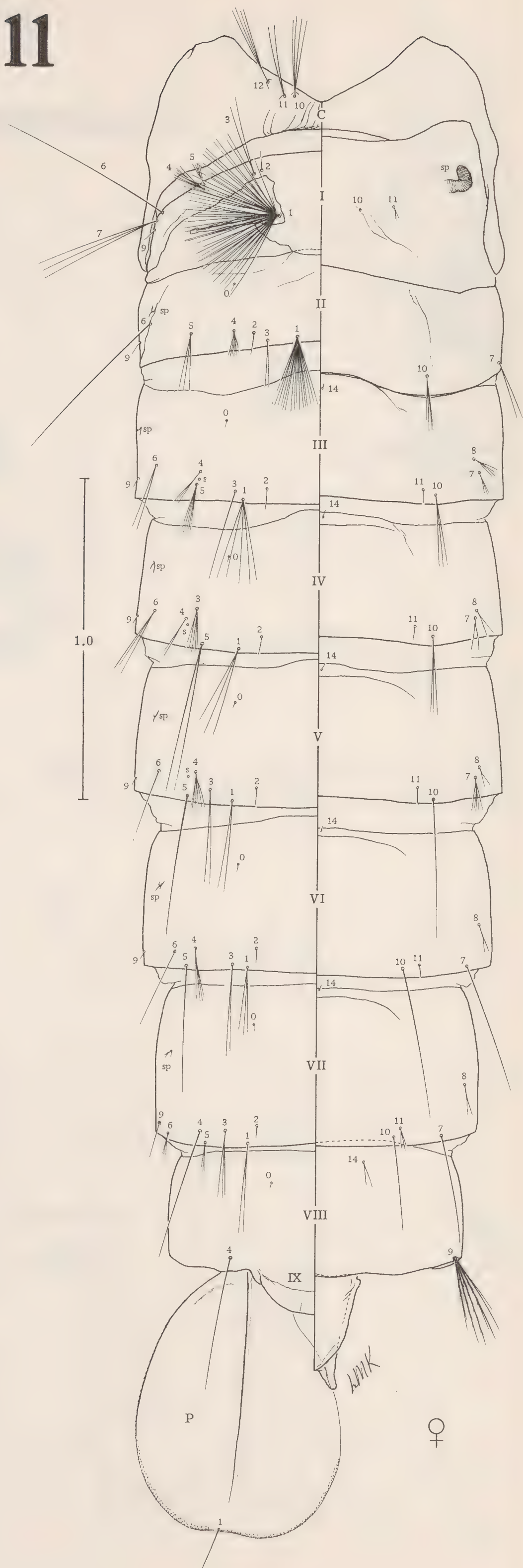
# Fig. 11

## OCHLEROTATUS



## deficiens

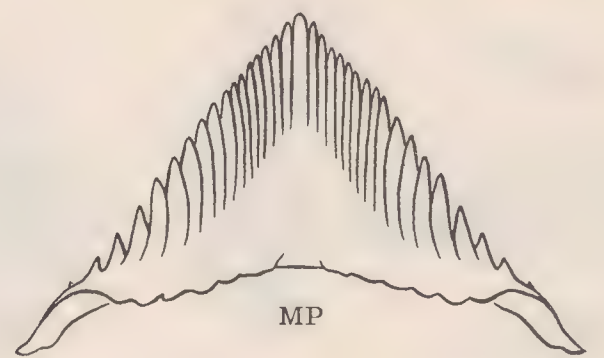
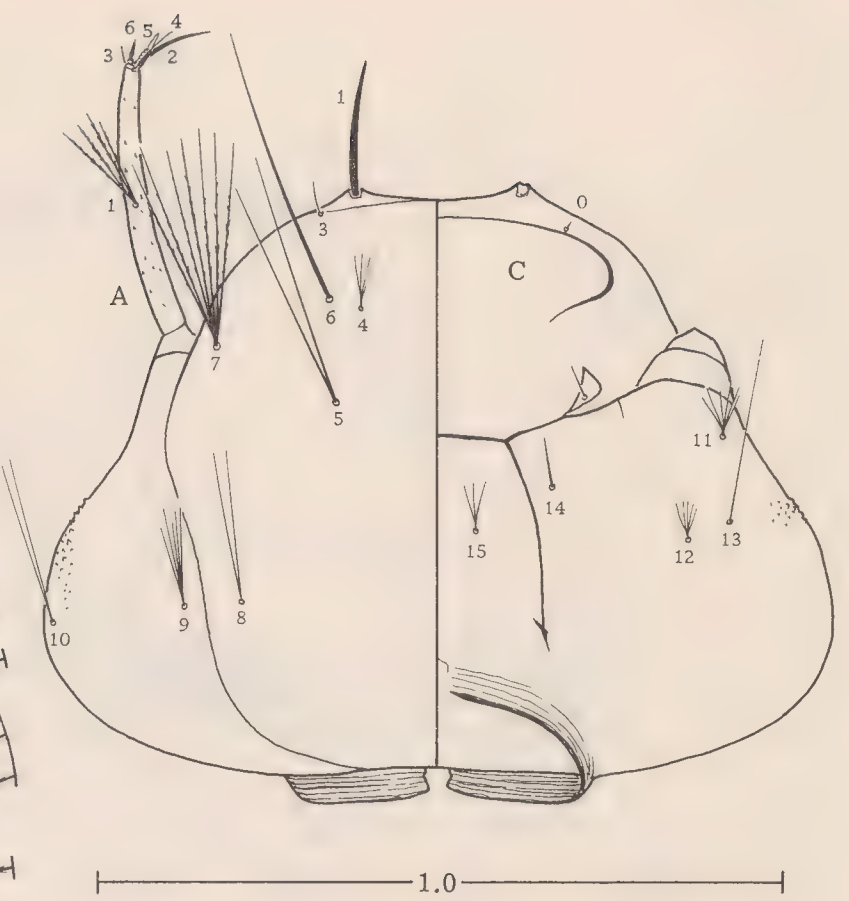
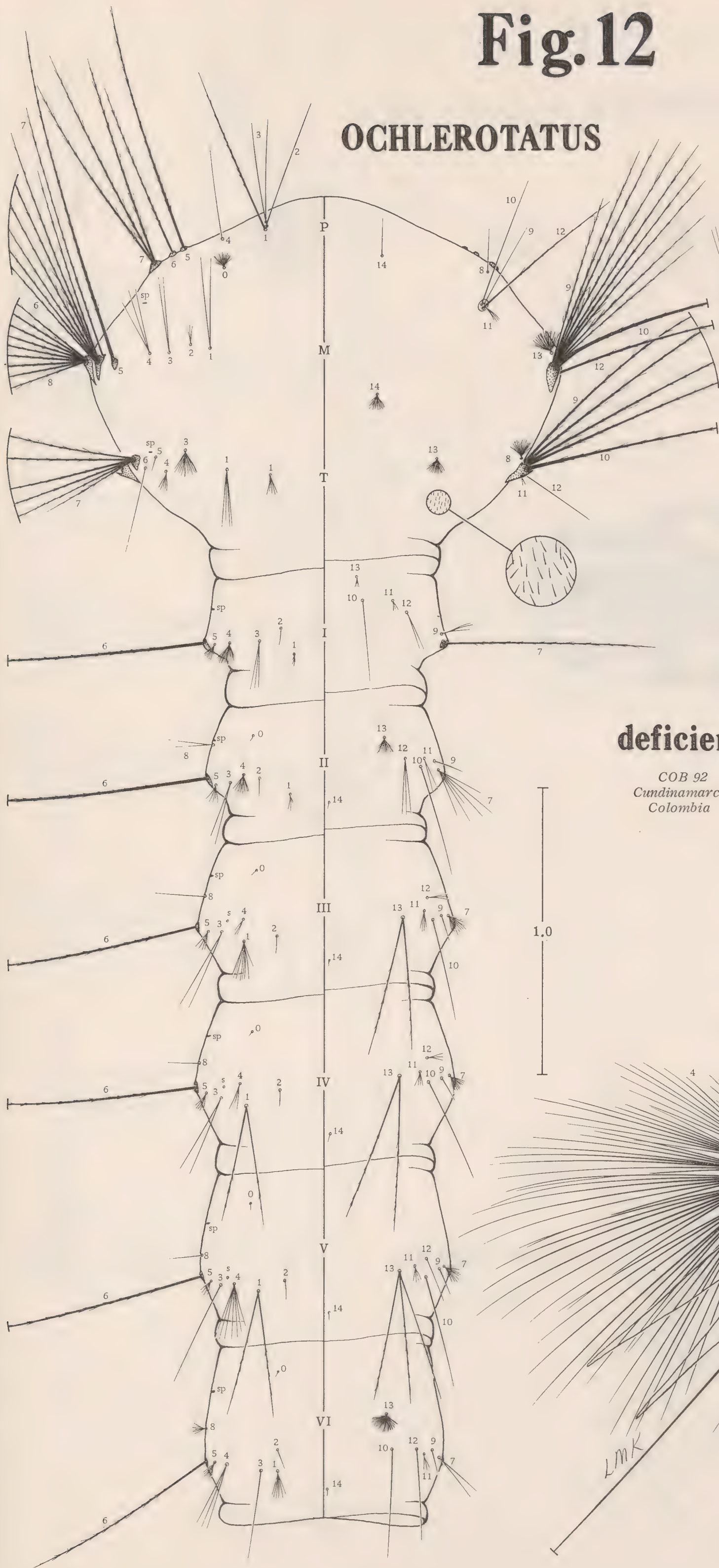
COB 92  
Cundinamarca  
Colombia





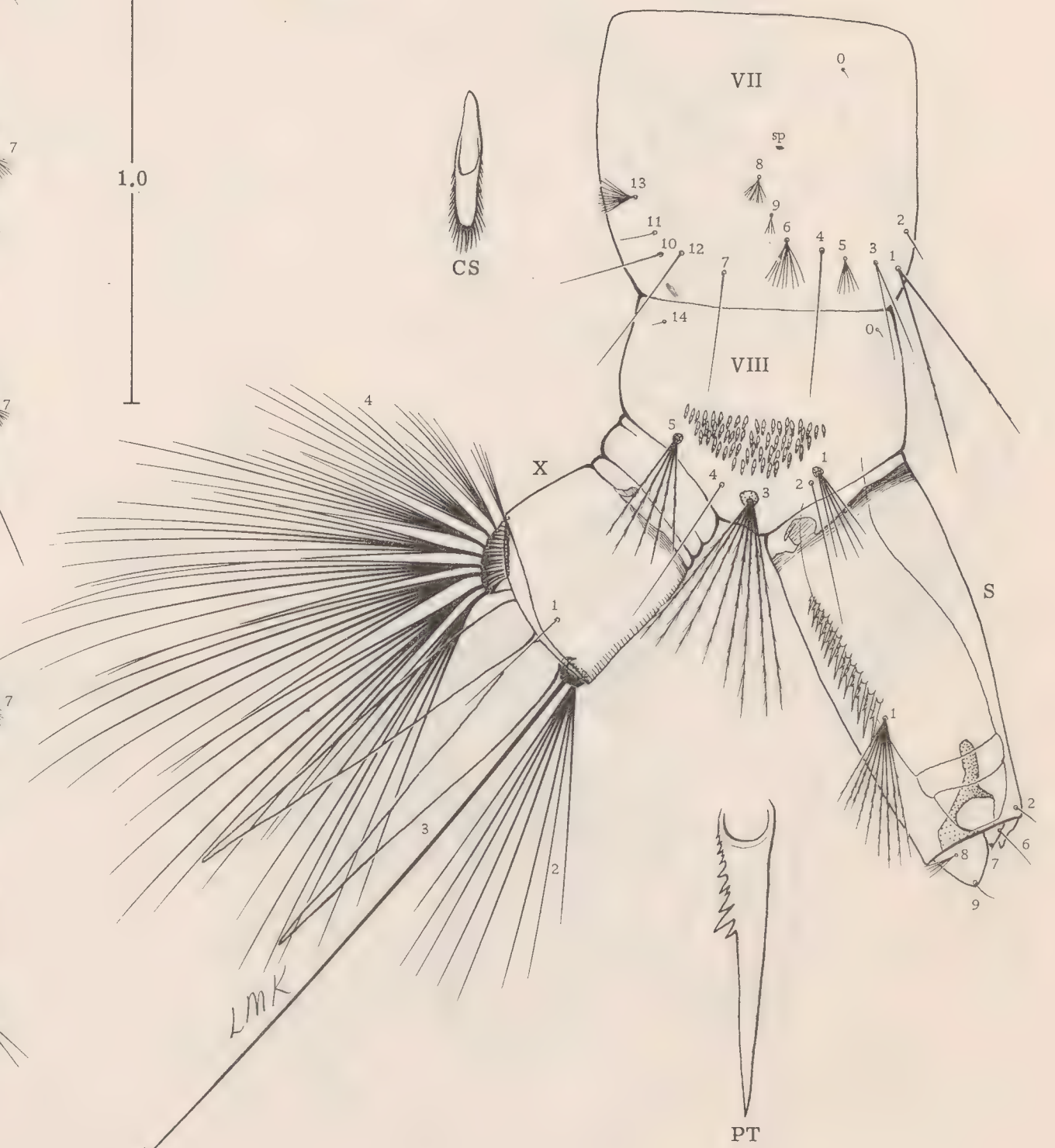
# Fig.12

## OCHLEROTATUS



## deficiens

COB 92  
Cundinamarca  
Colombia



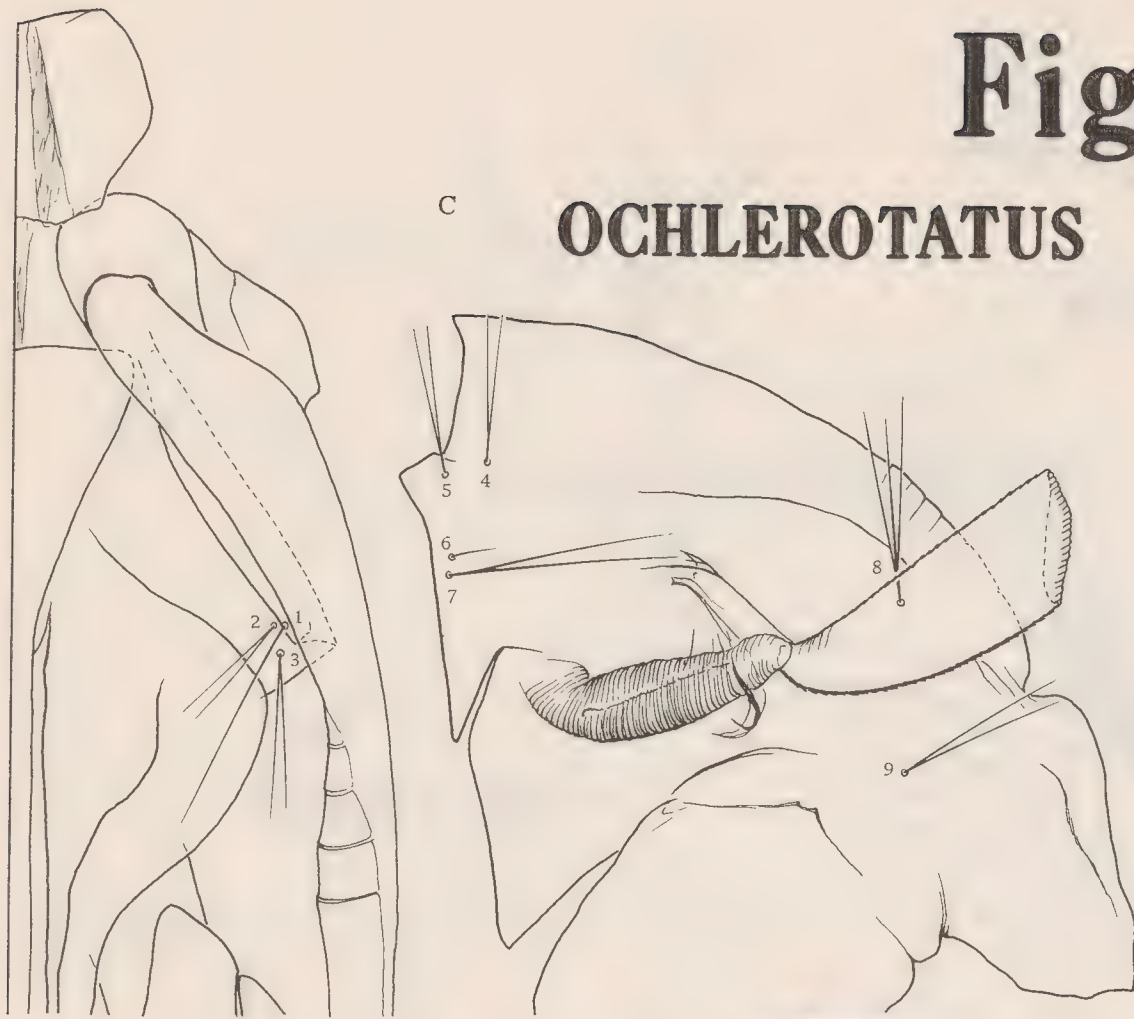


# Fig.13

## OCHLEROTATUS

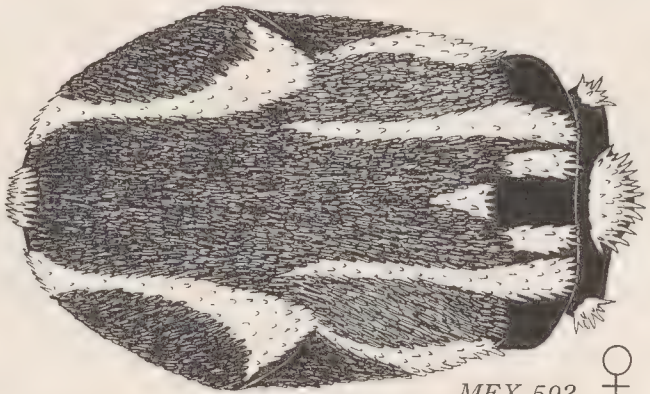
C

MEX 609



MEX 610

♂

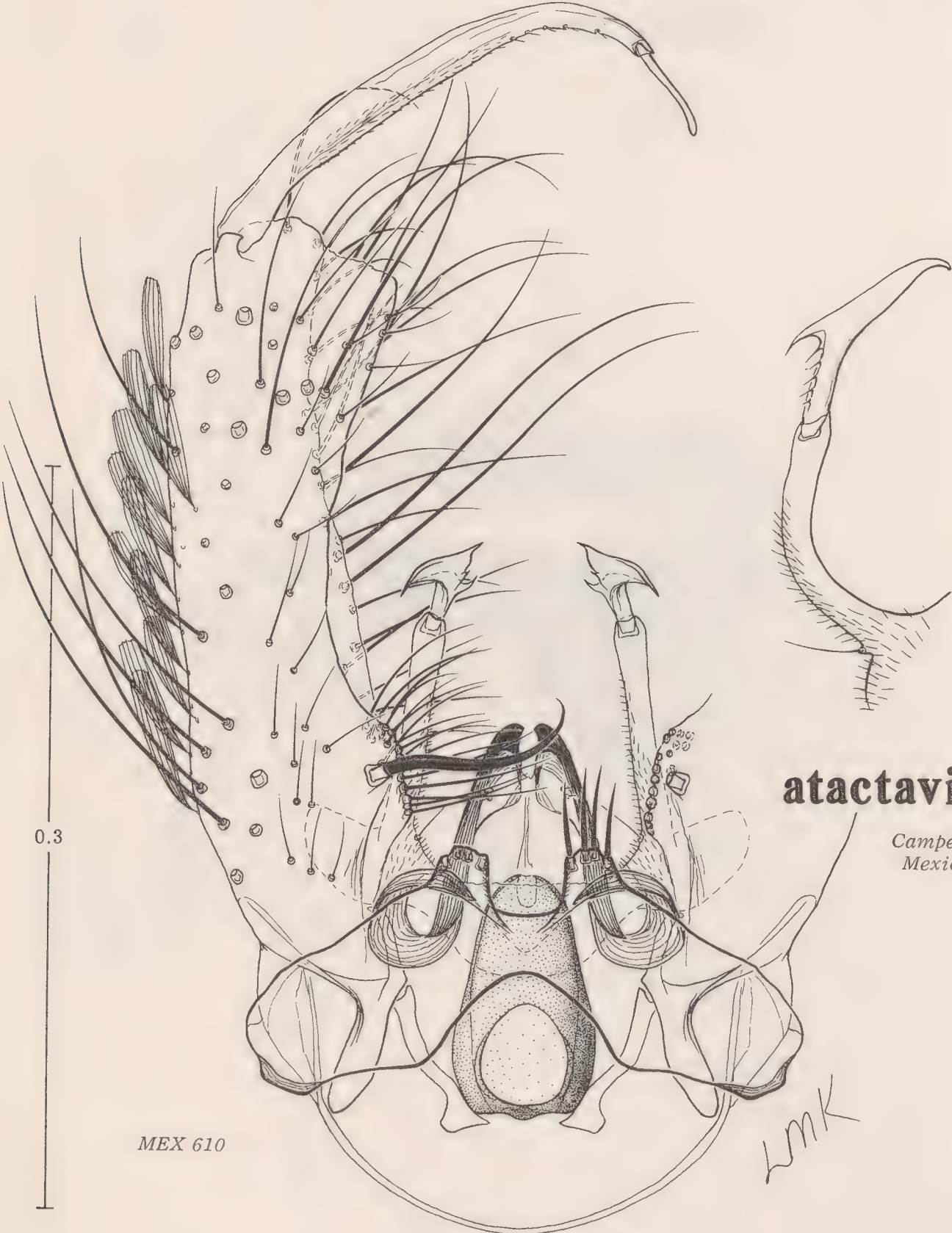


MEX 592

♀

1.0

1.0

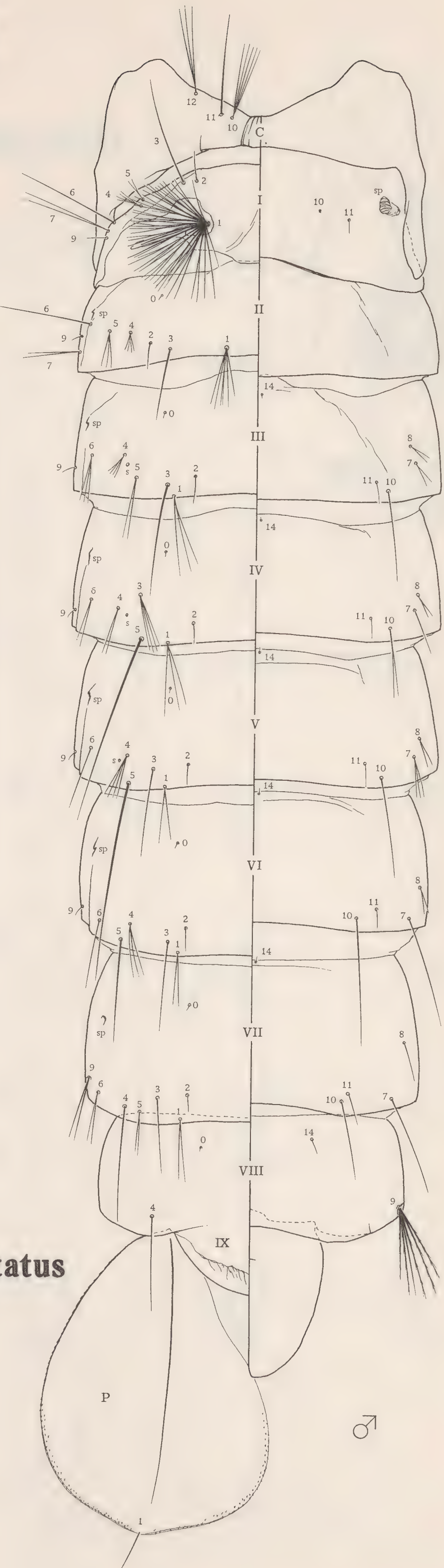


0.3

MEX 610

## atactavittatus

Campeche  
Mexico

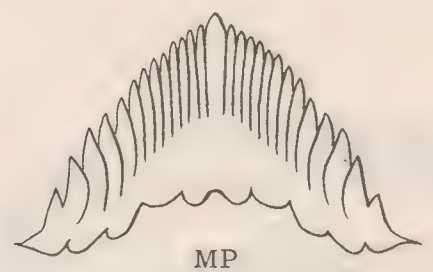
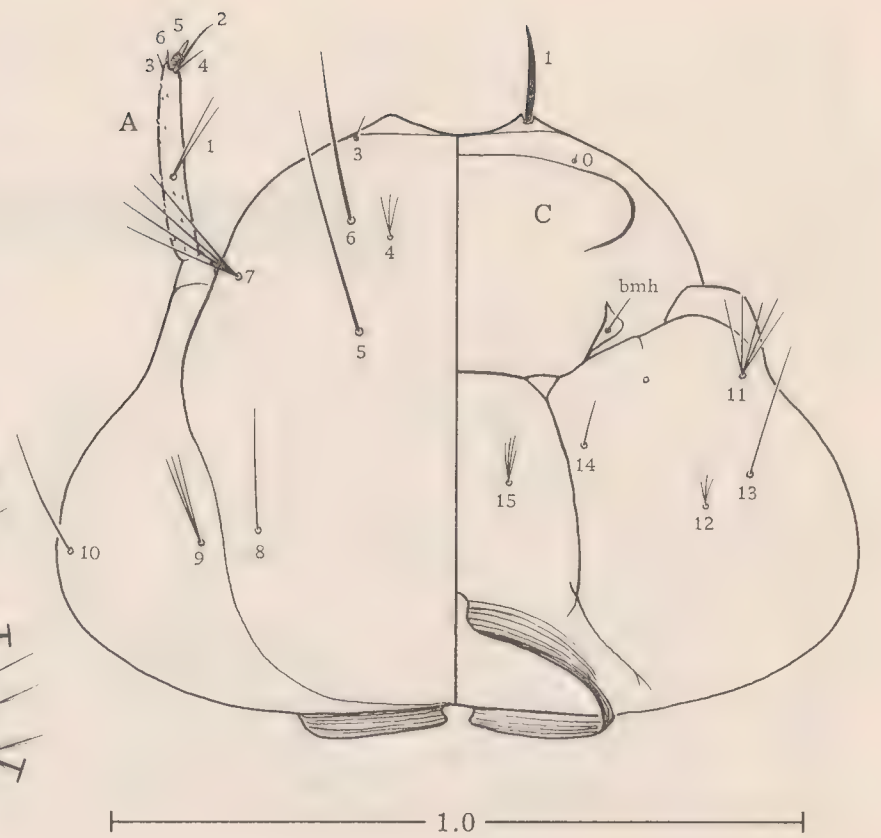
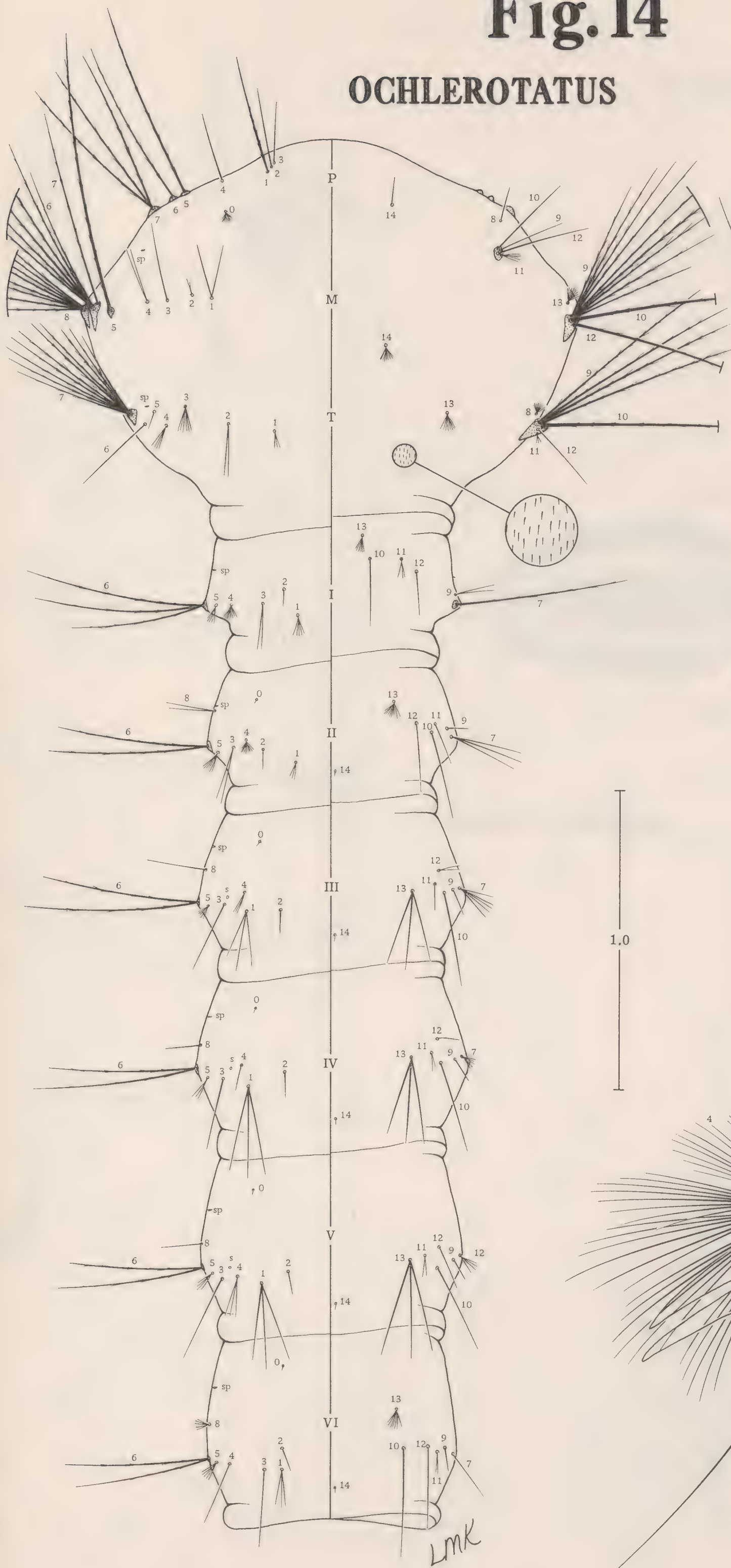


♂



# Fig.14

## OCHLEROTATUS



## atactavittatus

MEX 609  
Campeche  
Mexico

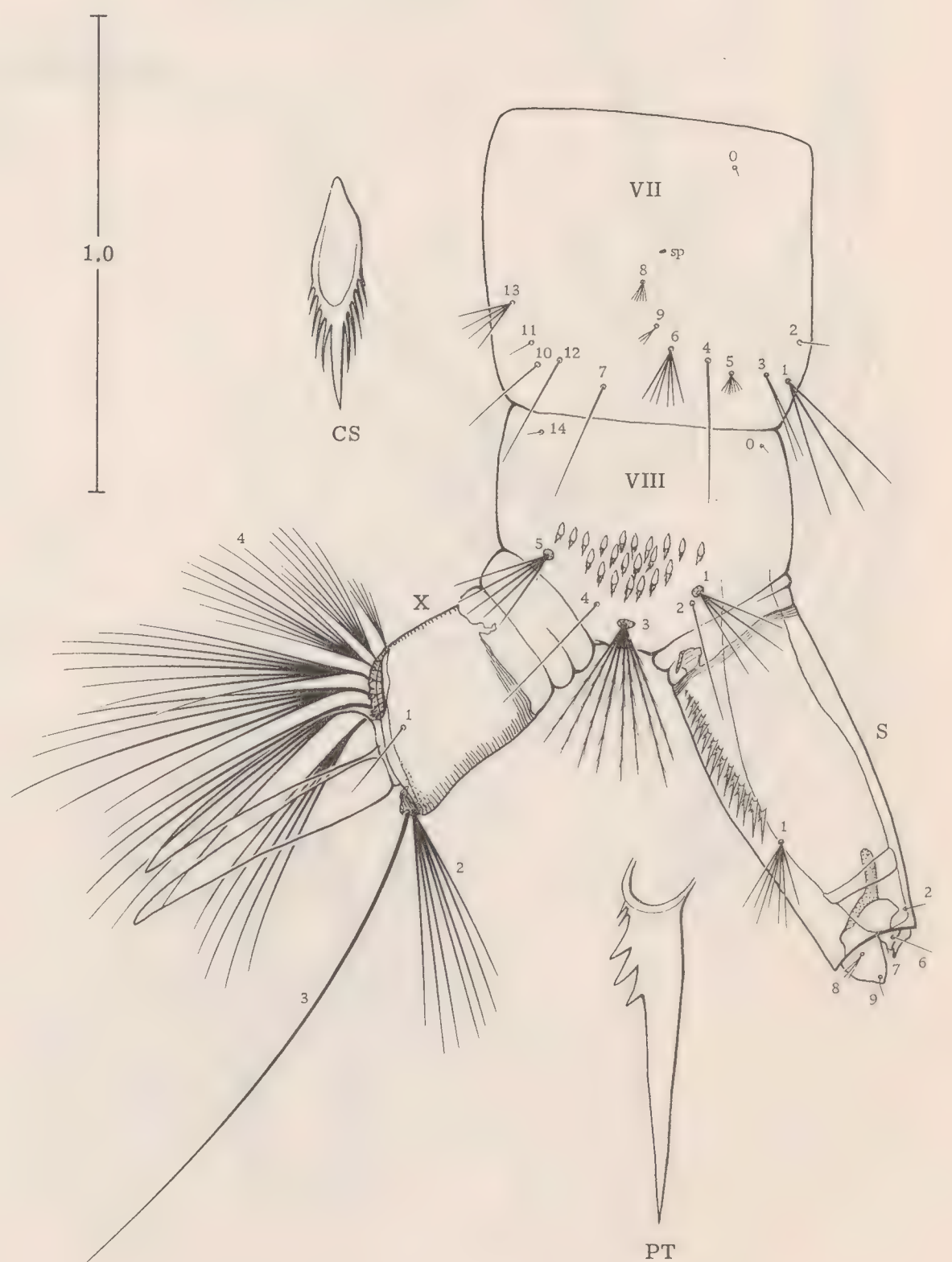
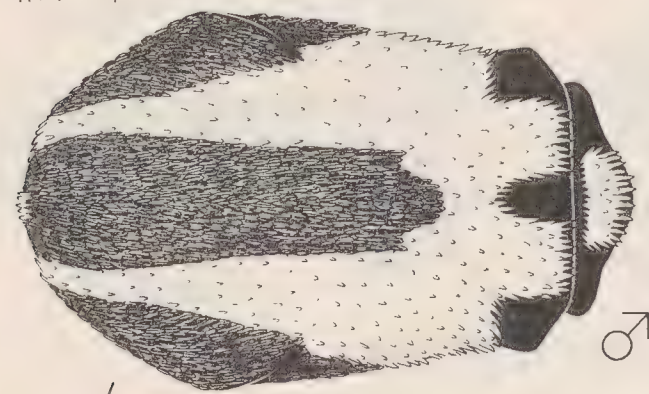
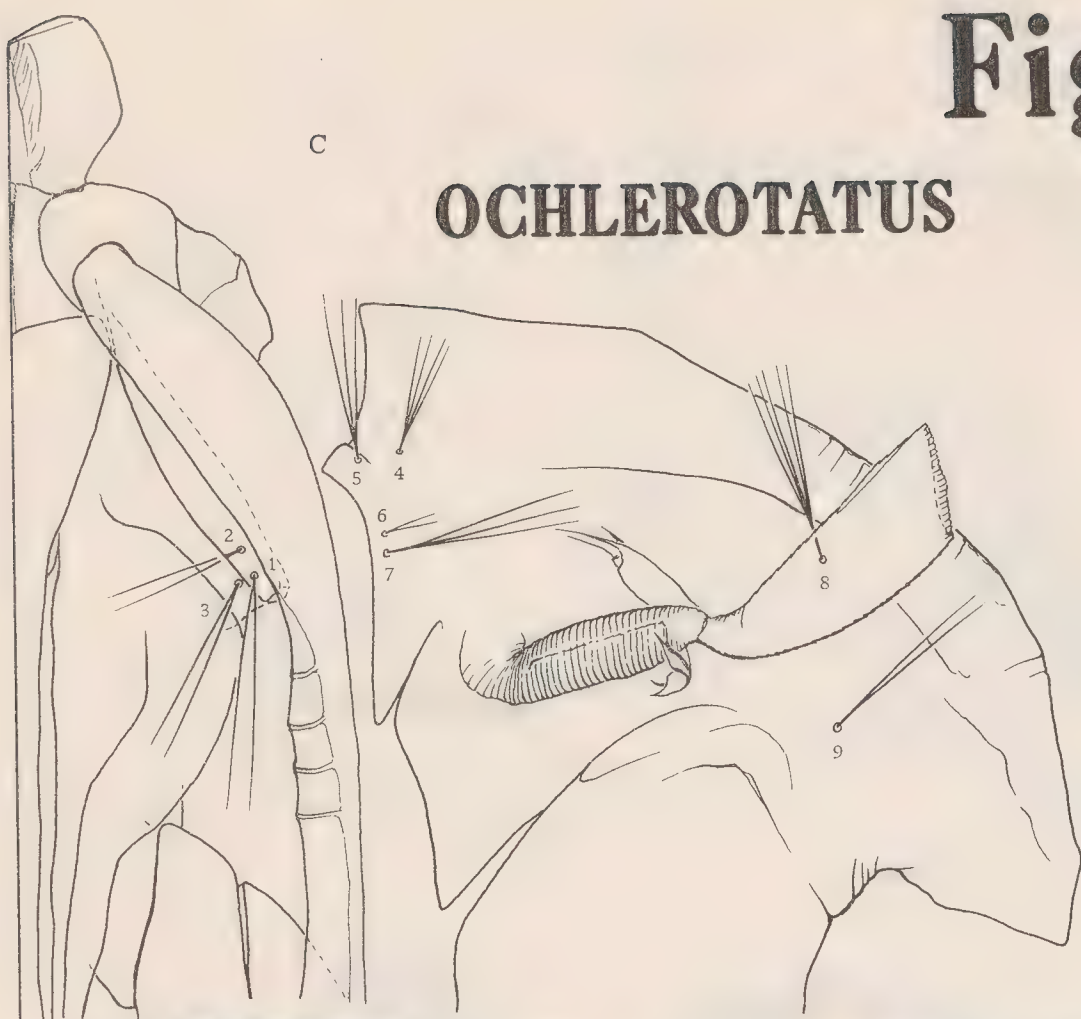


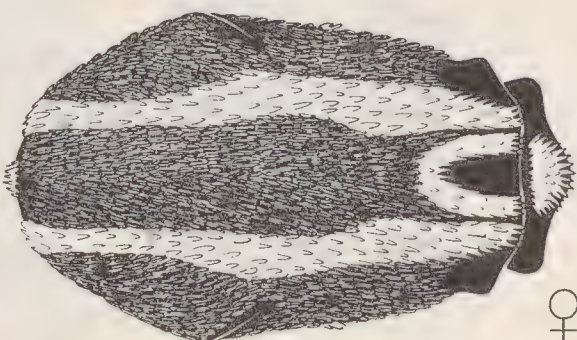


Fig. 15

OCHLEROTATUS



CR 154  
Cartago  
Costa Rica

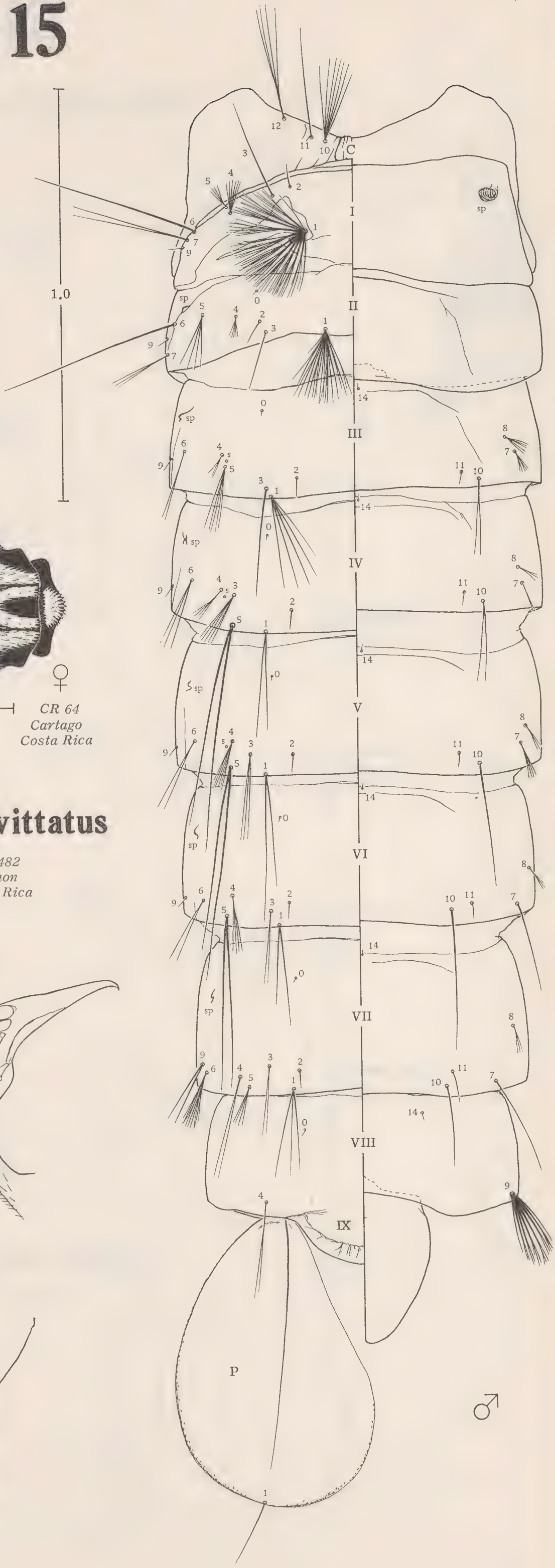


CR 64  
Cartago  
Costa Rica

1.0

angustivittatus

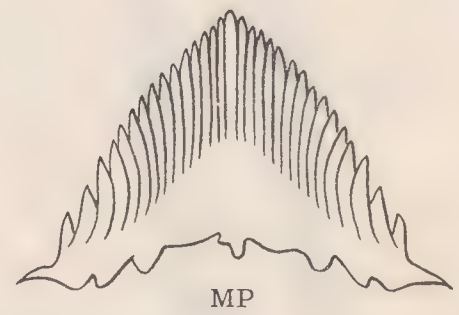
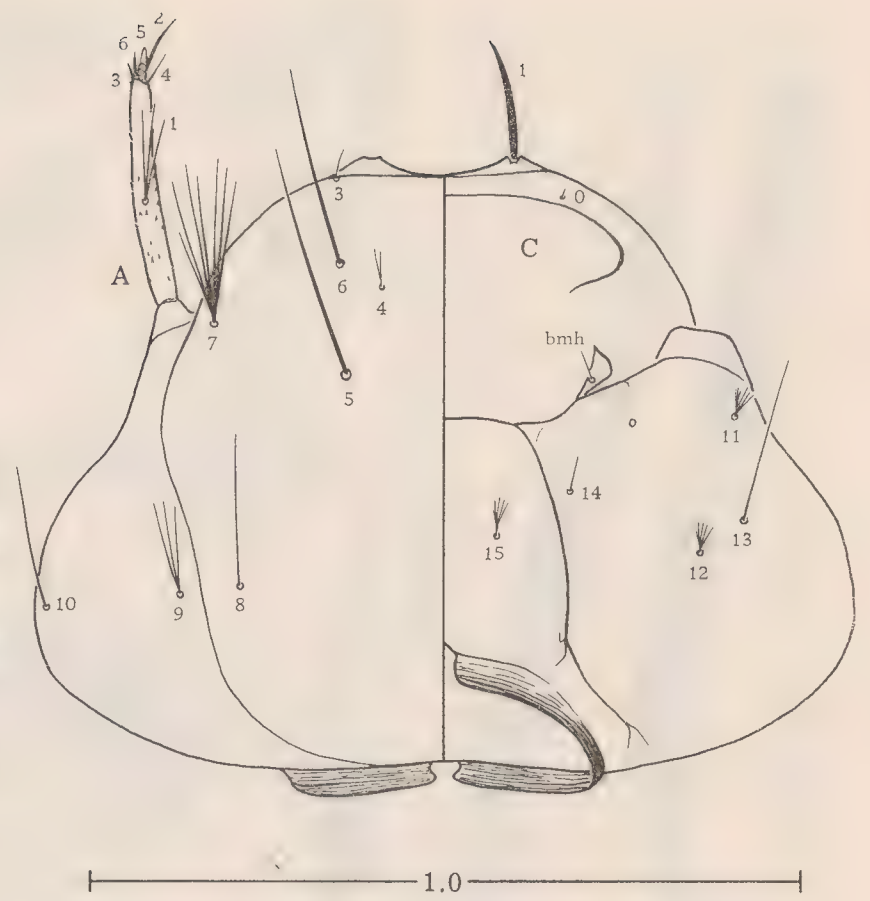
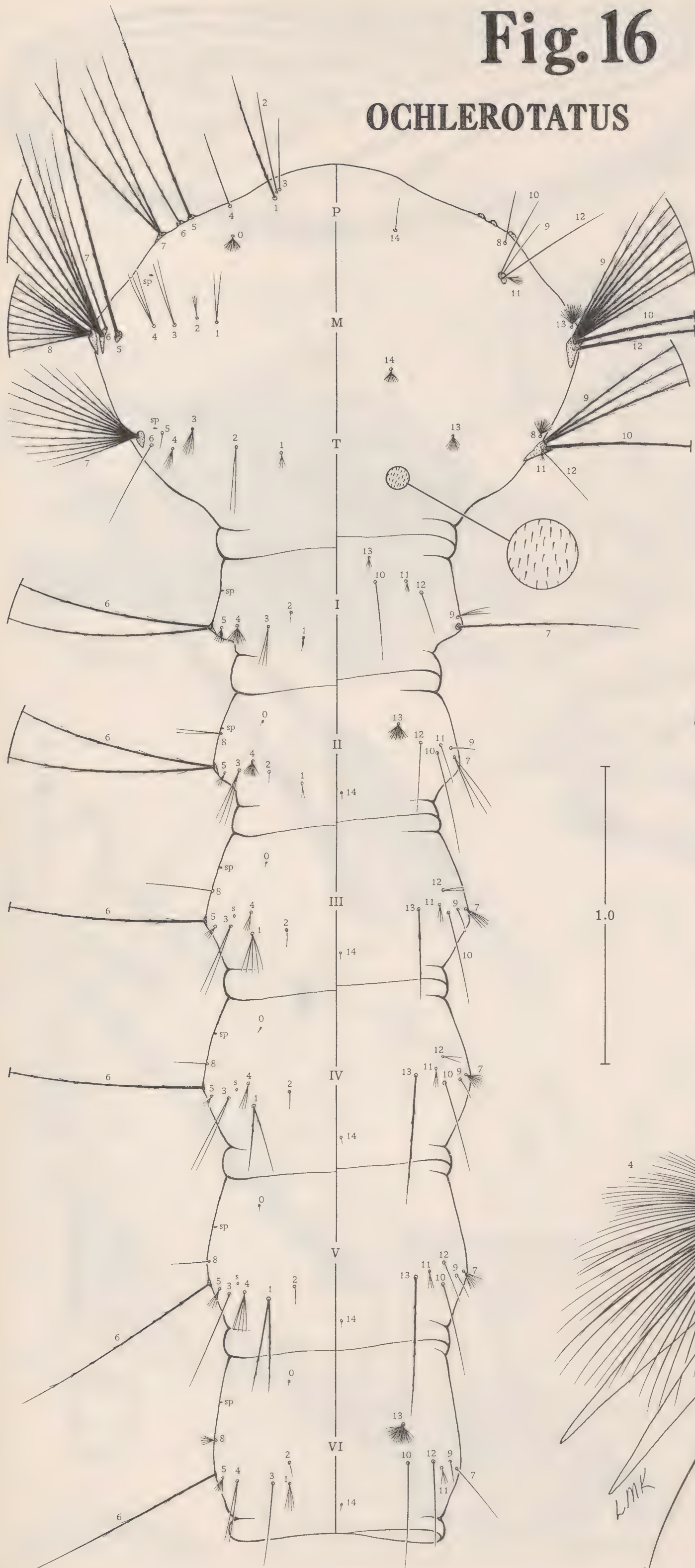
CR 482  
Limon  
Costa Rica





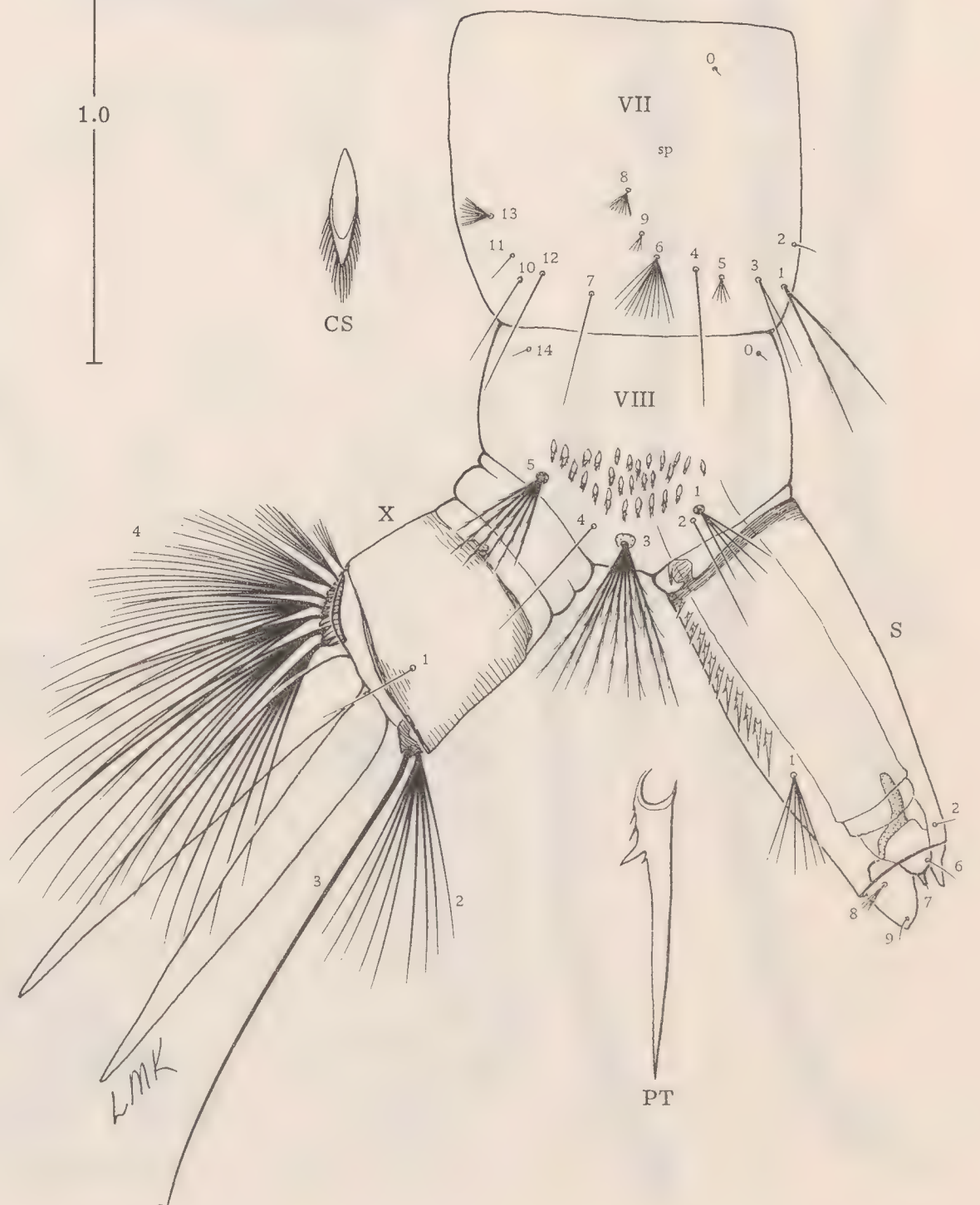
# Fig. 16

## OCHLEROTATUS



## angustivittatus

CR 482  
Limon  
Costa Rica

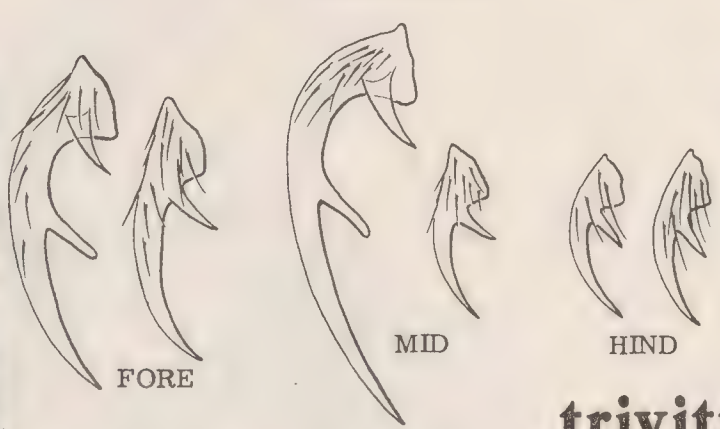
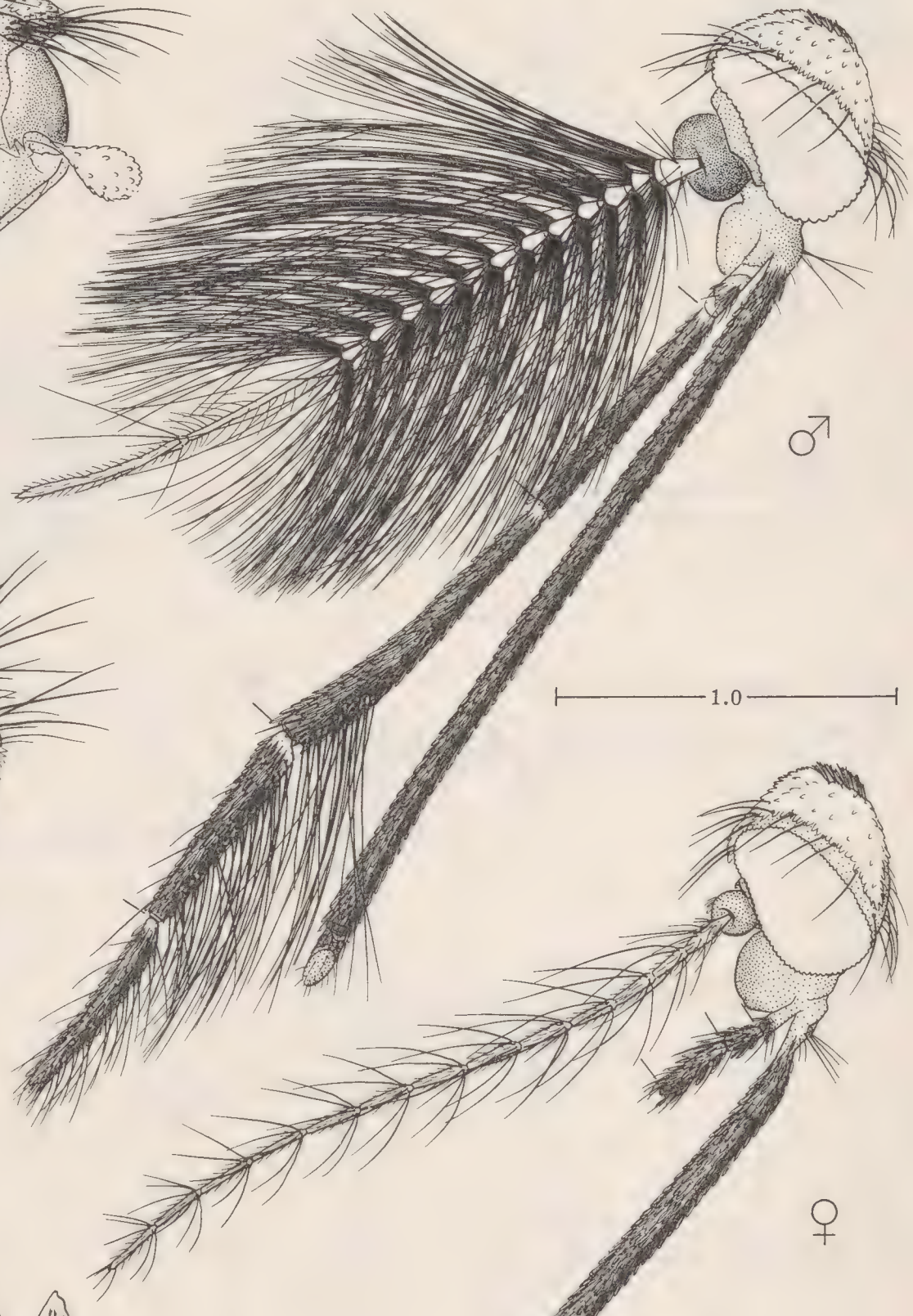
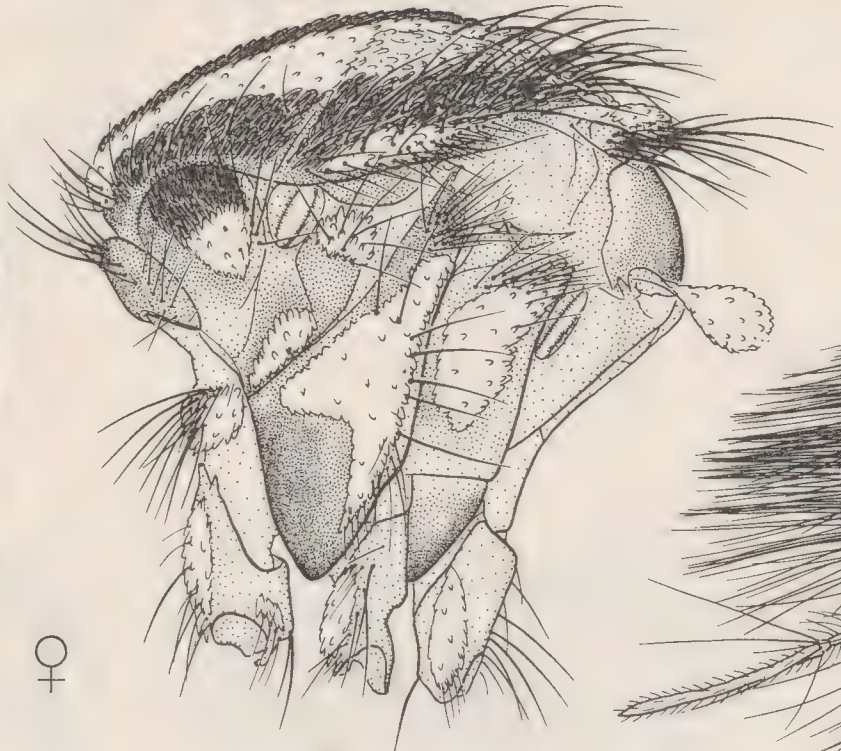
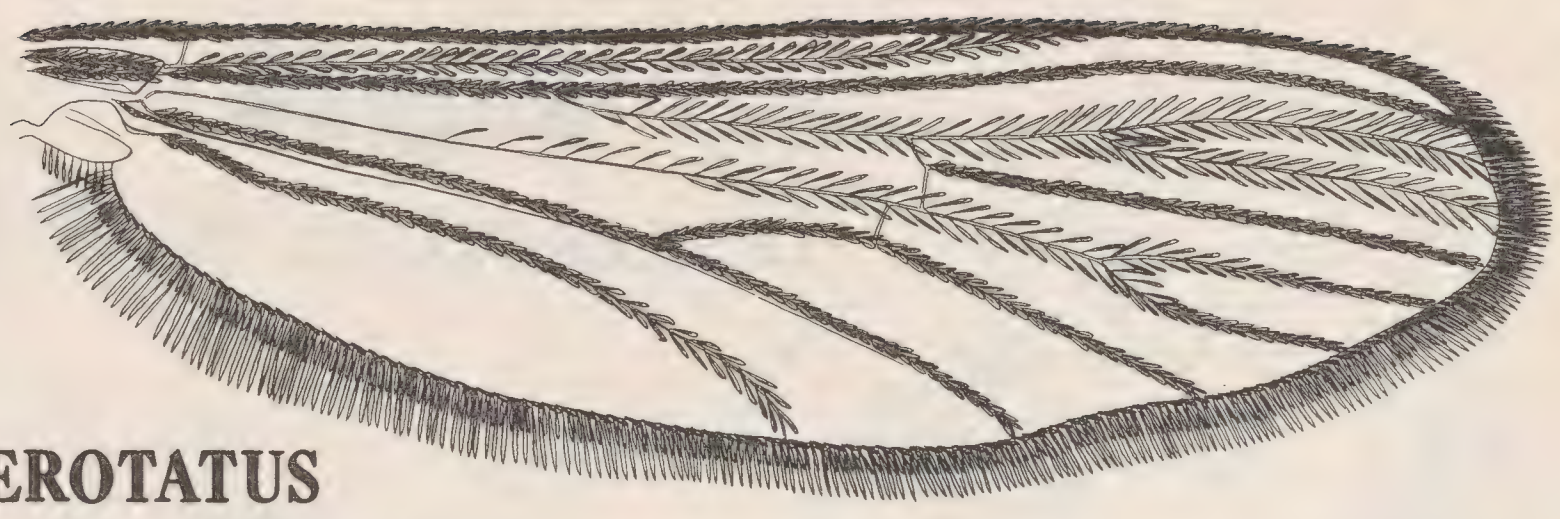






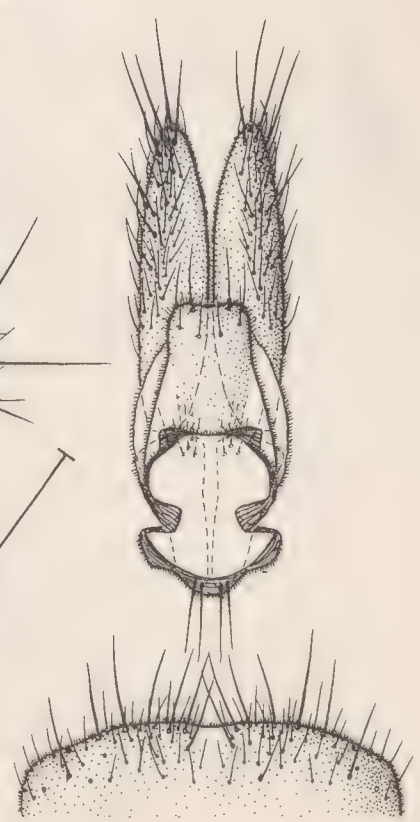
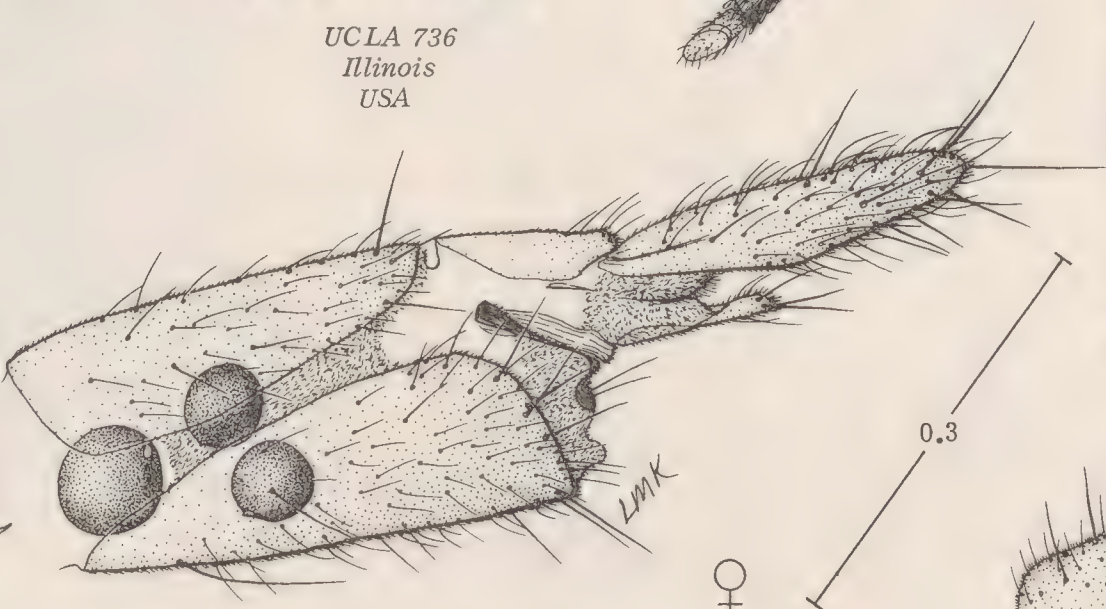
**Fig.  
17**

**OCHLEROTATUS**



**trivittatus**

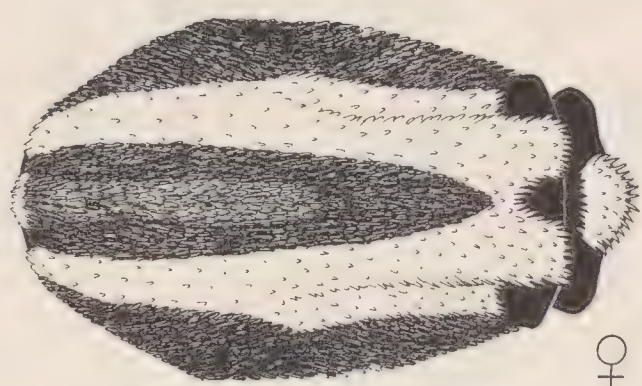
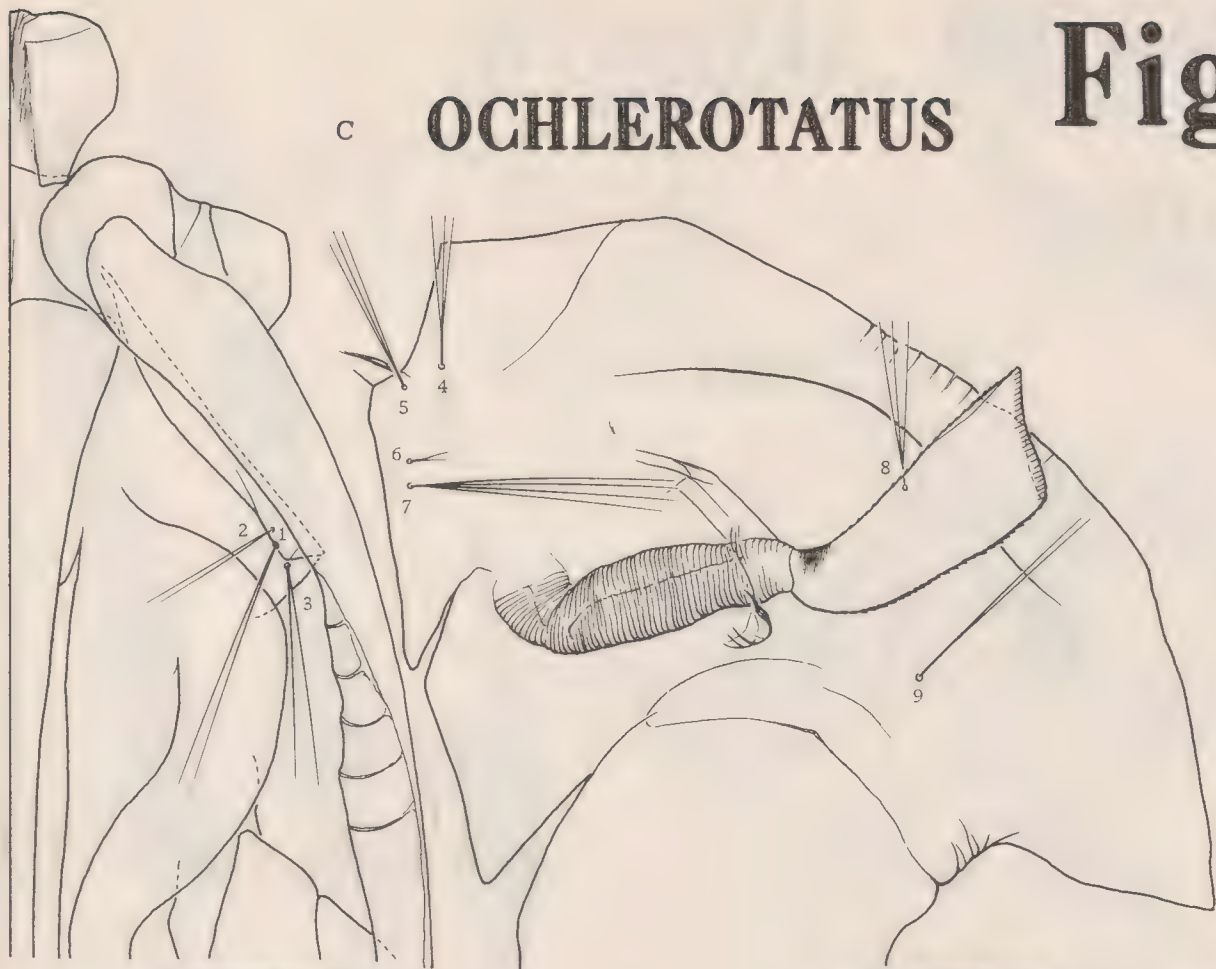
UCLA 736  
Illinois  
USA





c OCHLEROTATUS

Fig. 18



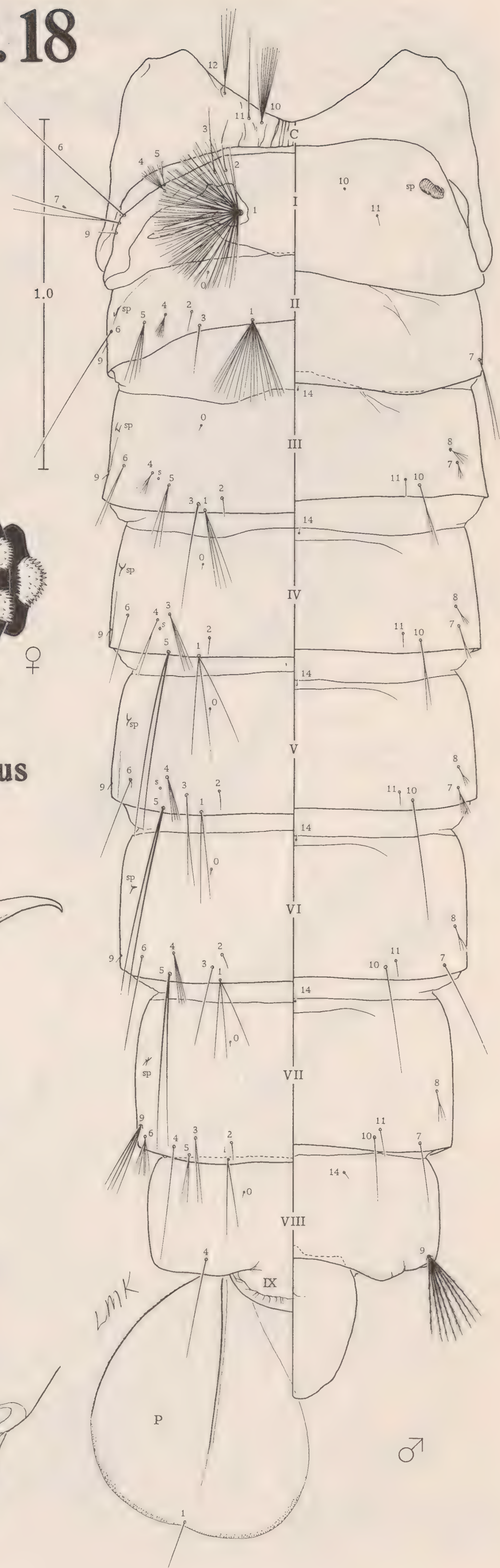
1.0

trivittatus

UCLA 736  
Illinois  
USA



0.3



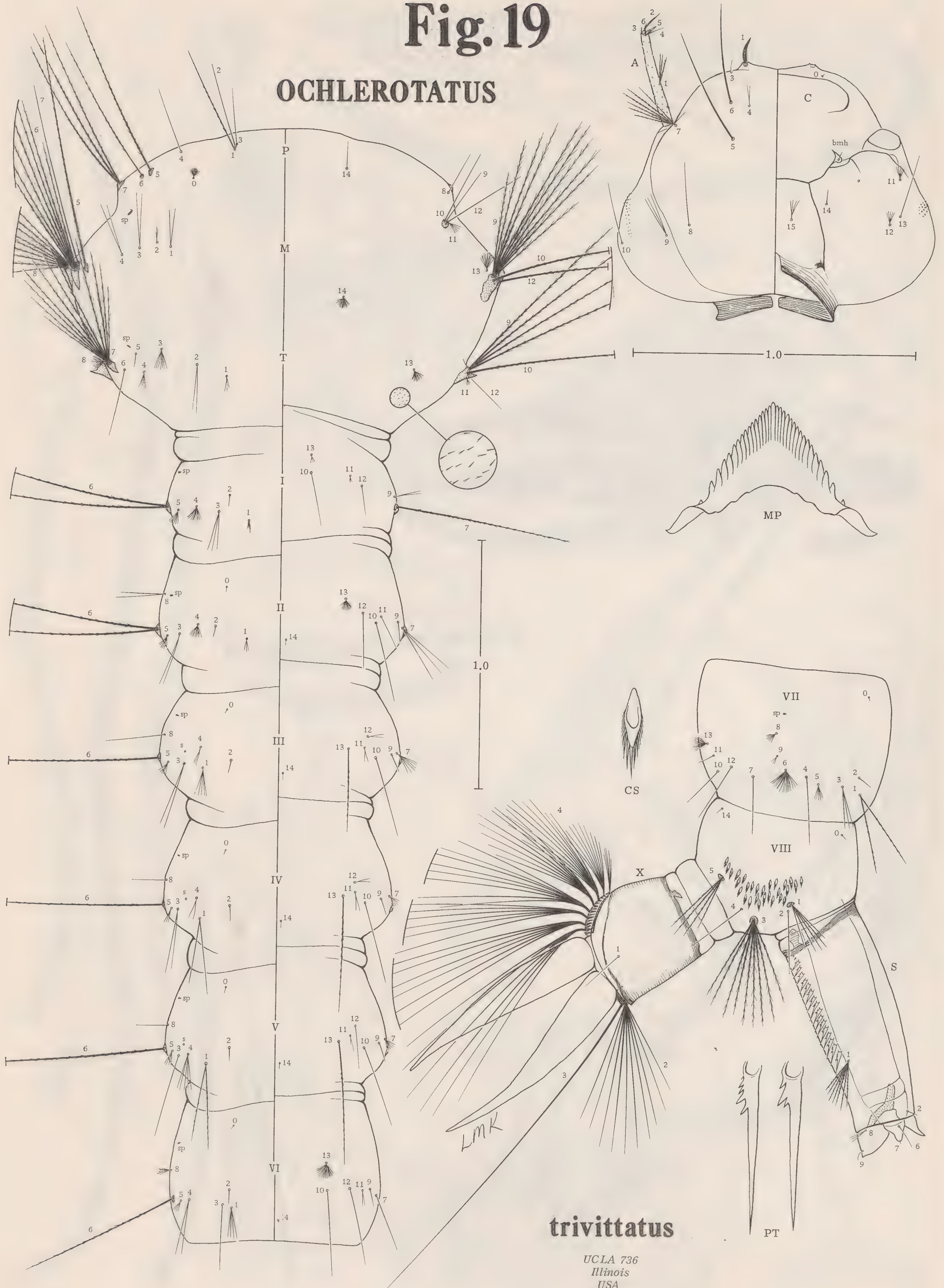
1.0

♂



# Fig. 19

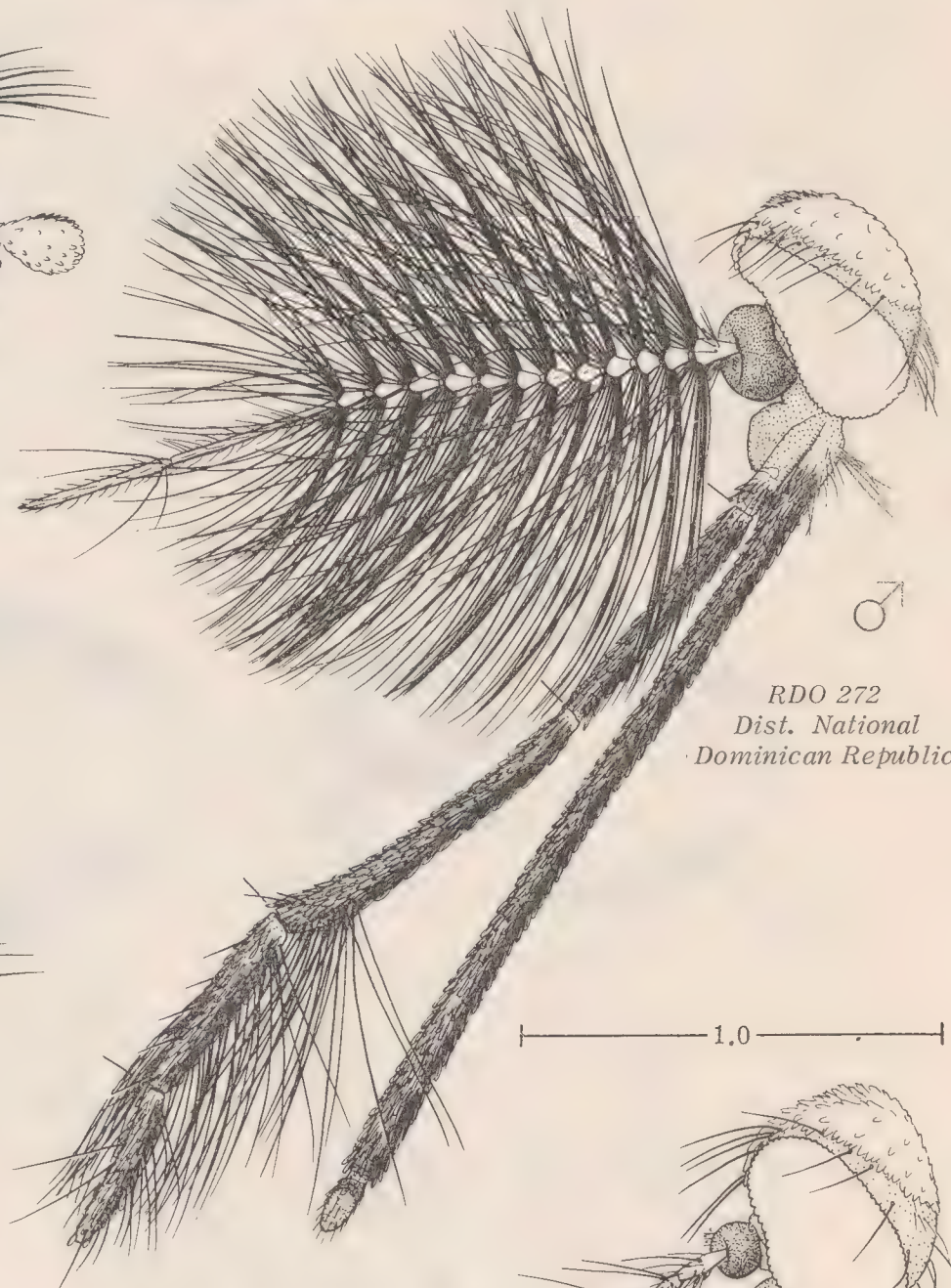
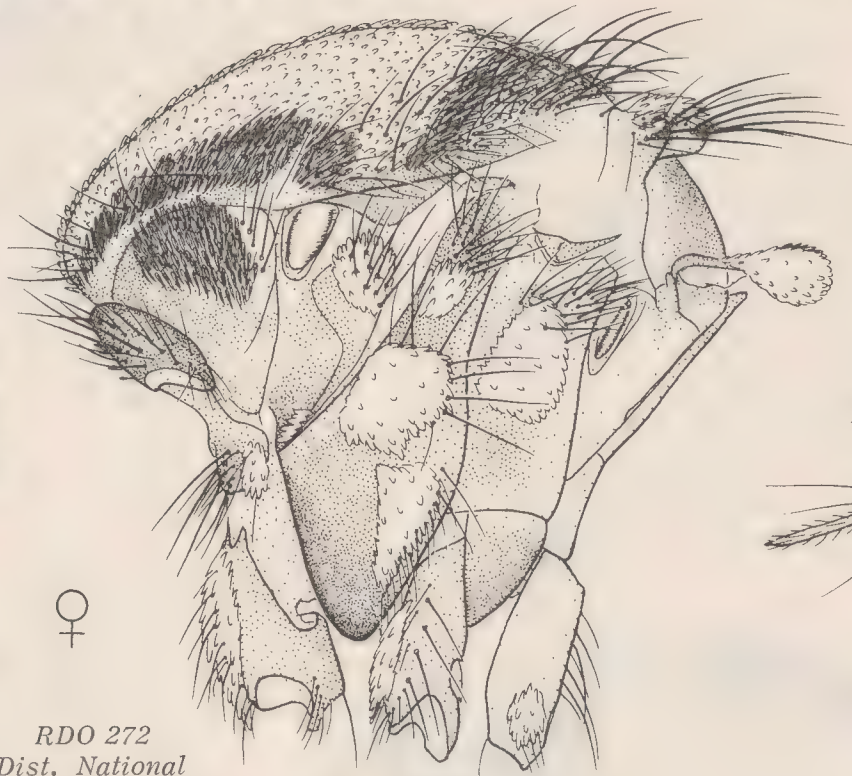
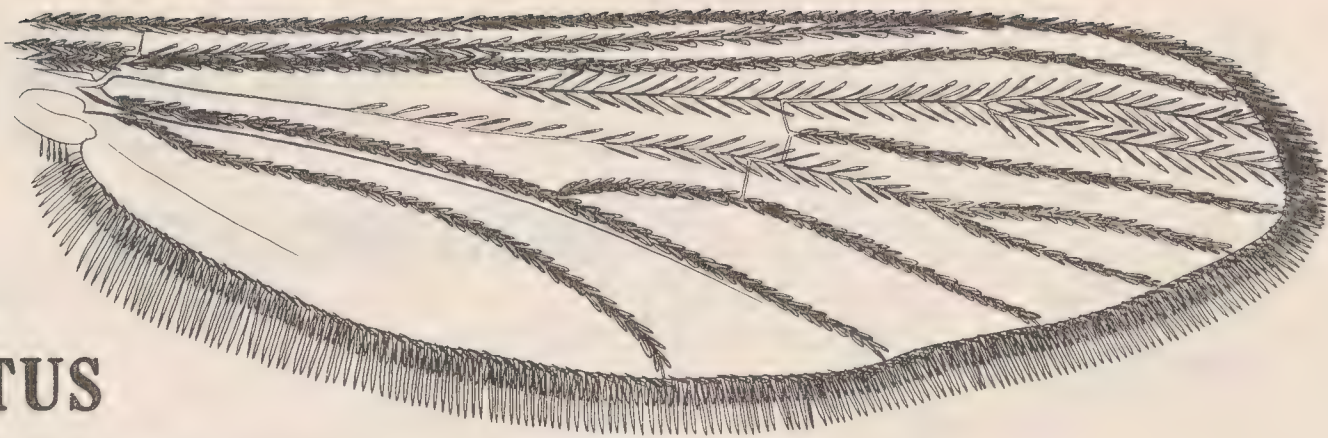
## OCHLEROTATUS



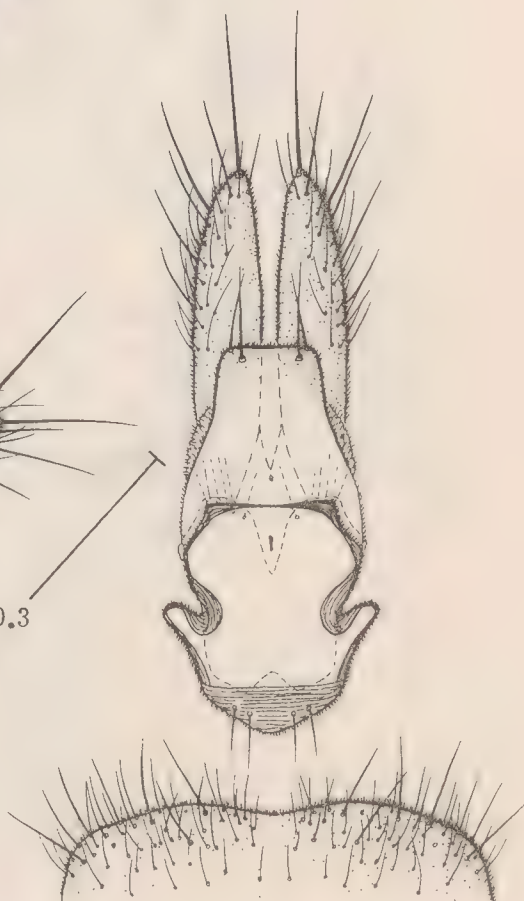
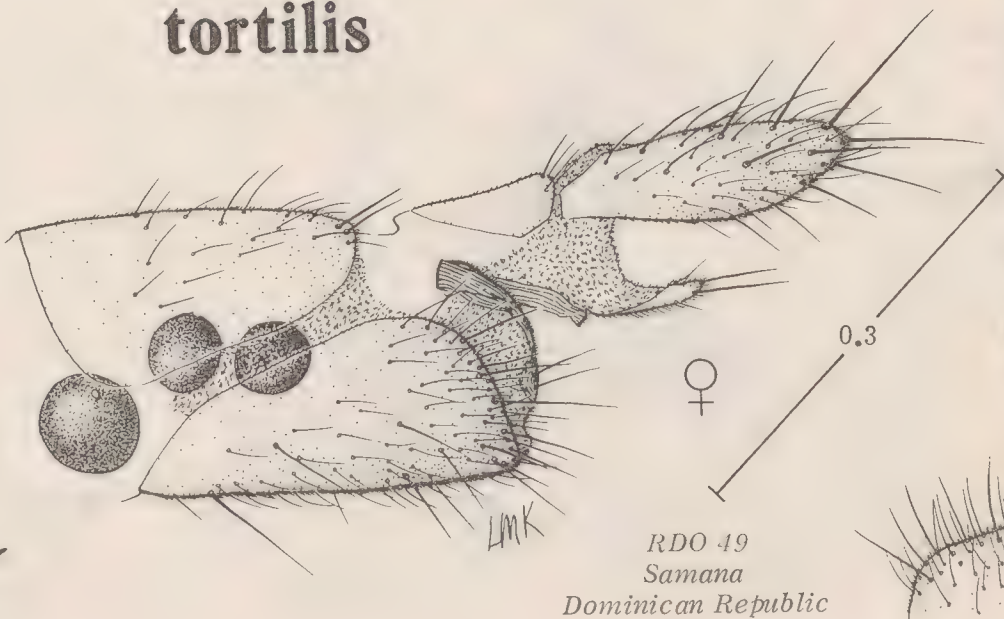


# Fig. 20

## OCHLEROTATUS



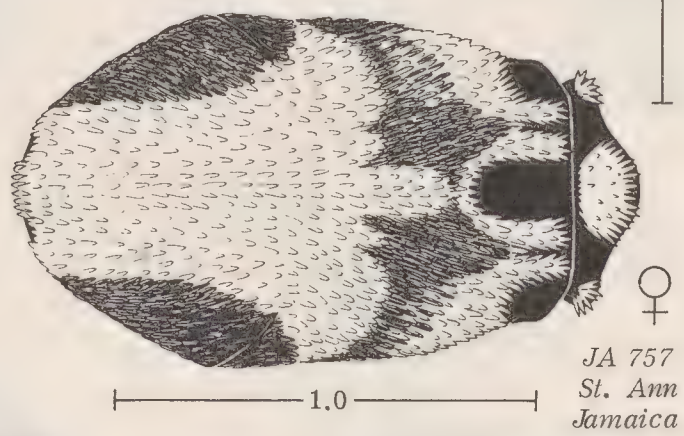
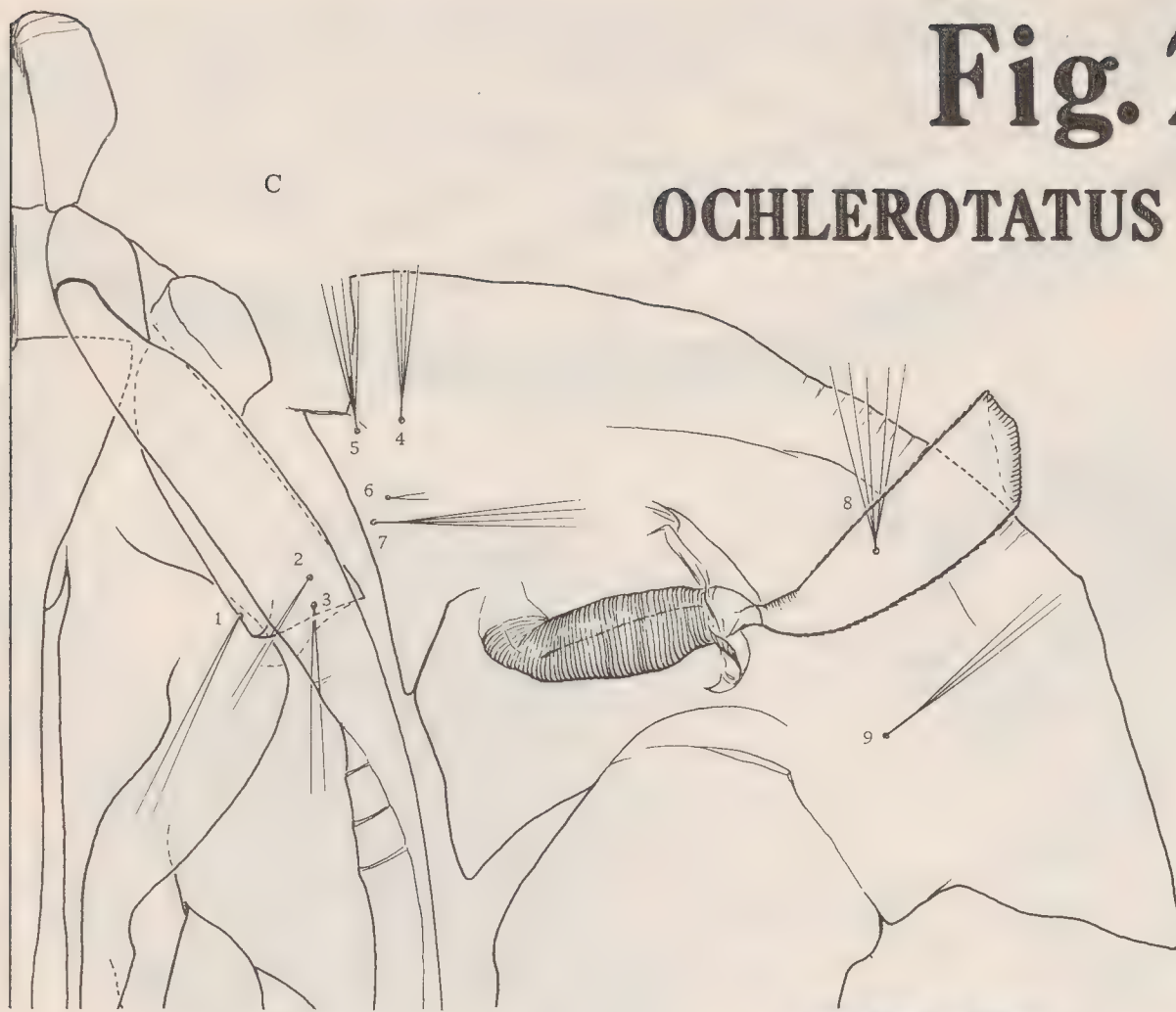
## tortilis





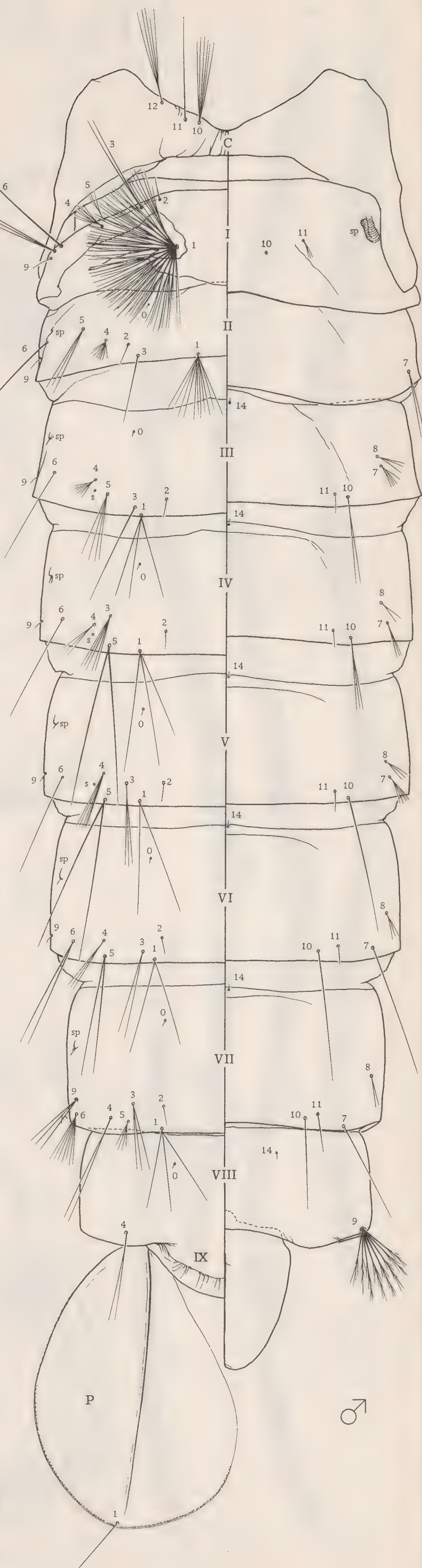
# Fig. 21

## OCHLEROTATUS



## tortilis

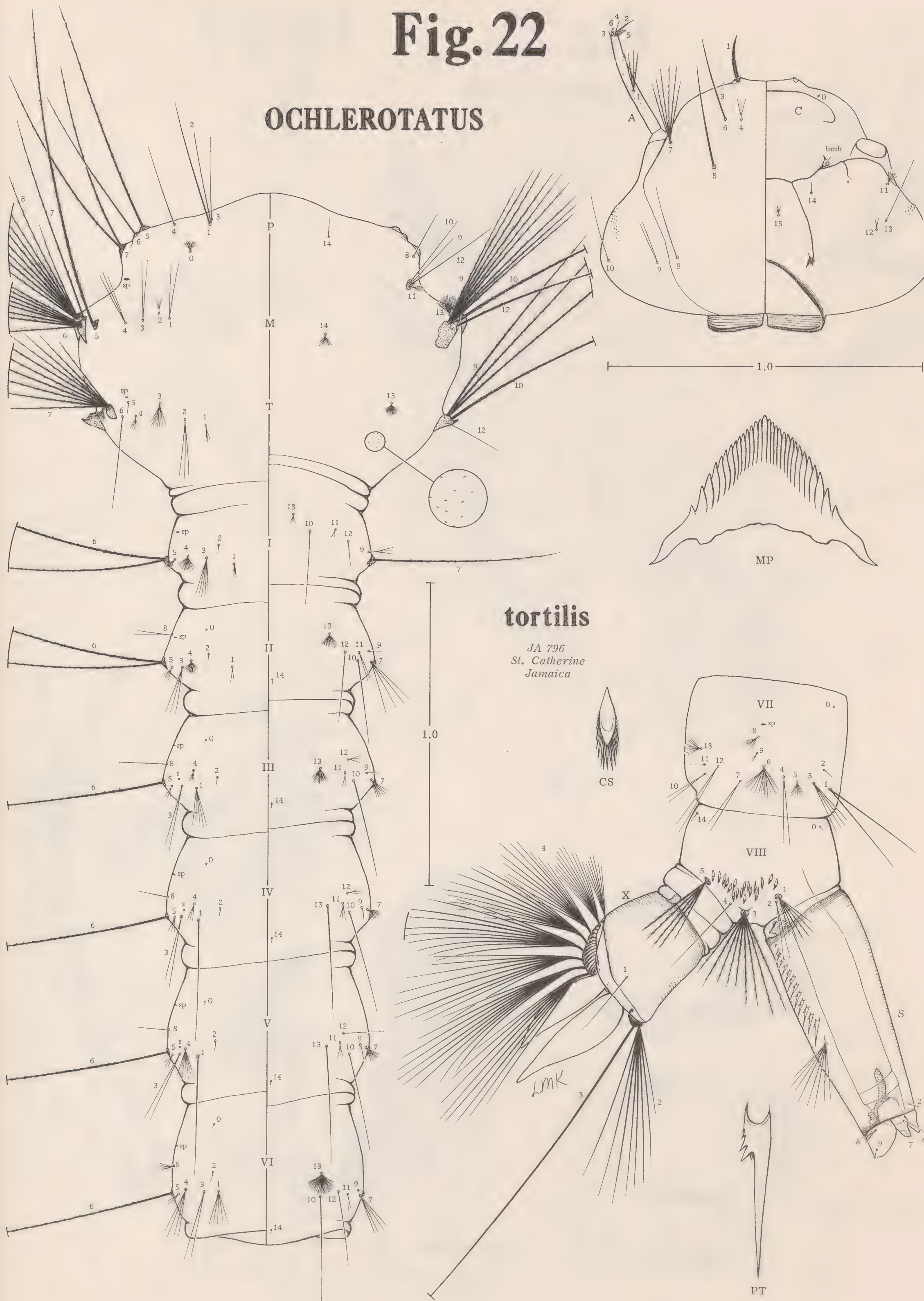
JA 796  
St. Catherine  
Jamaica





# Fig. 22

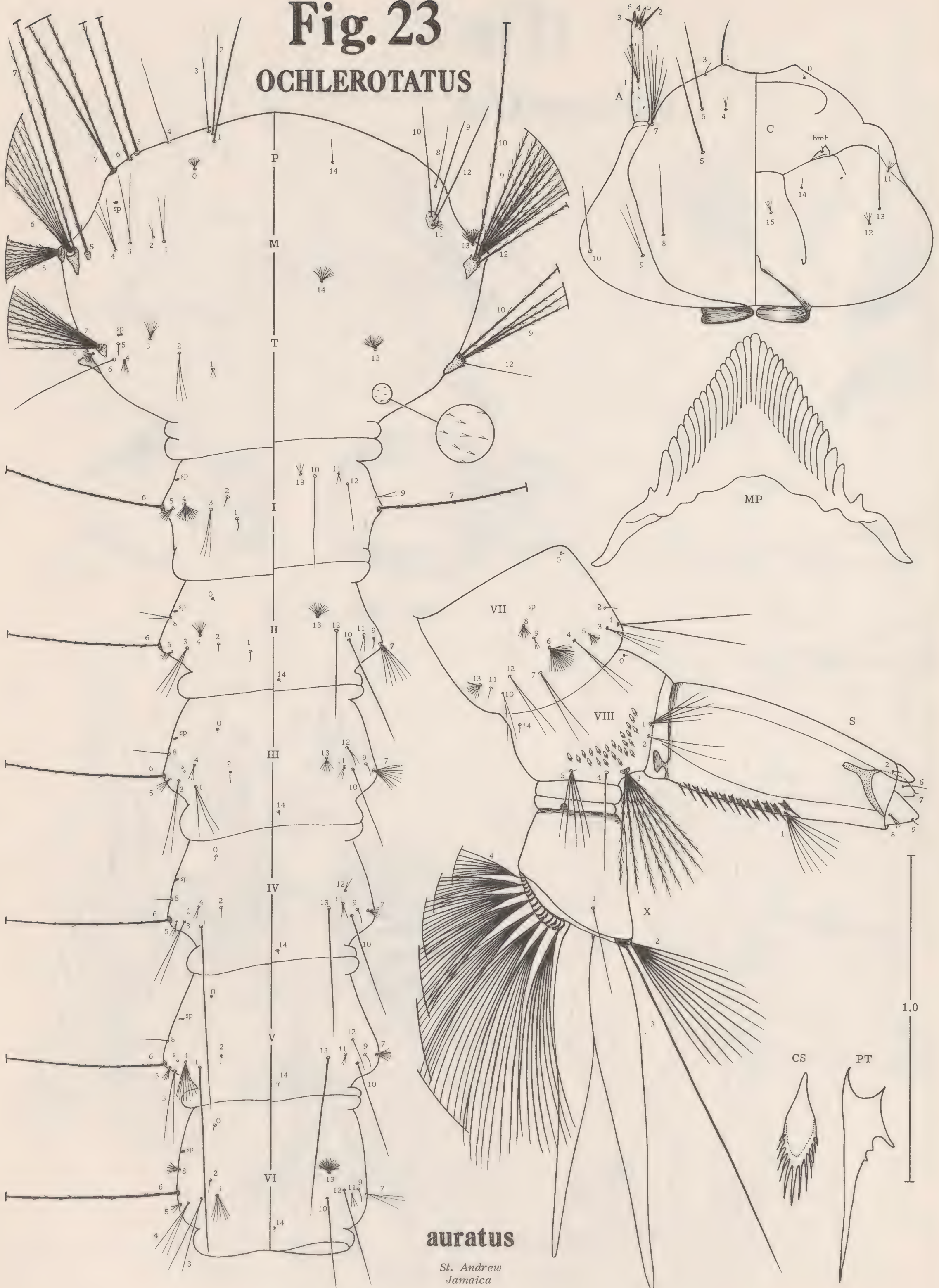
## OCHLEROTATUS





# Fig. 23

## UCHLEROTATUS



**auratus**

*St. Andrew  
Jamaica*

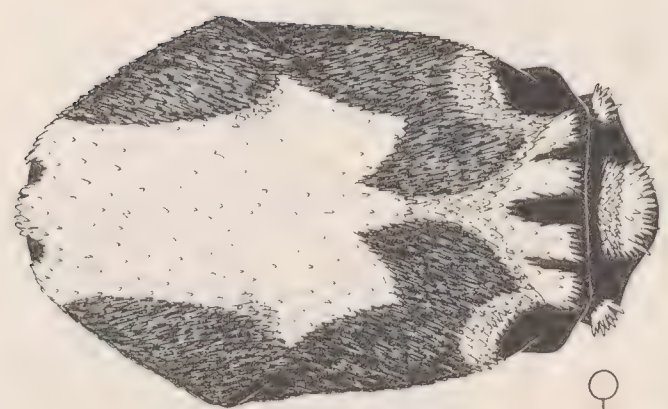


**Fig. 24**

**auratus**

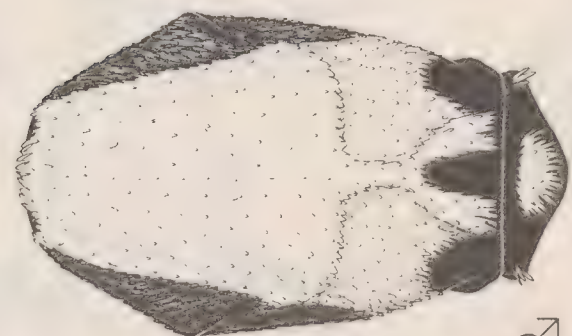
*Kingston  
Jamaica*

**OCHLEROTATUS**



♀

*New Providence  
Bahama Islands*



♂

*Cuba*

**condolescens**



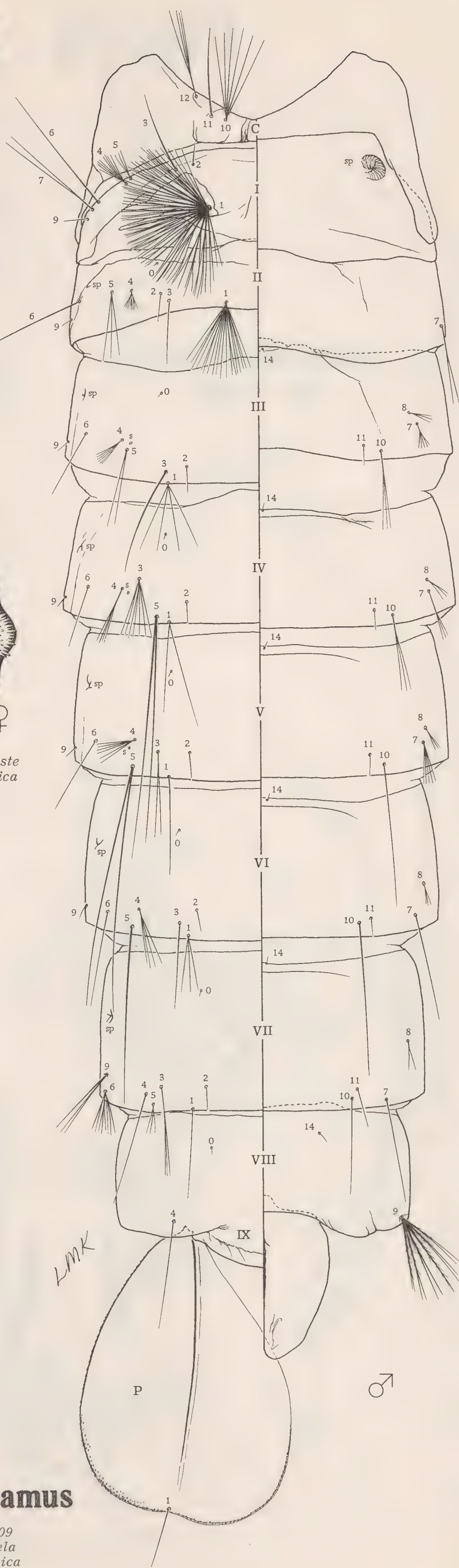
Fig. 25

OCHLEROTATUS



euplocamus

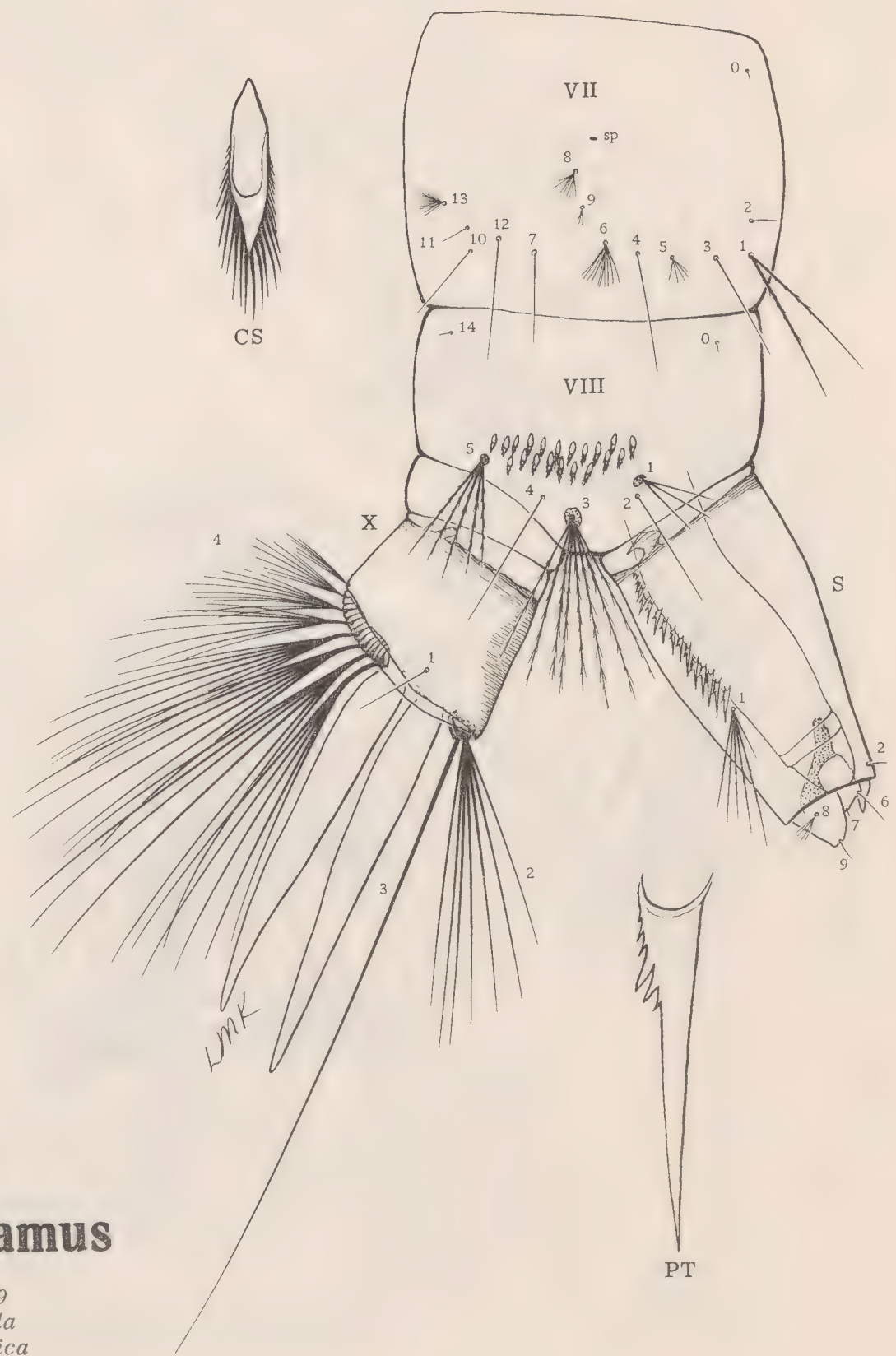
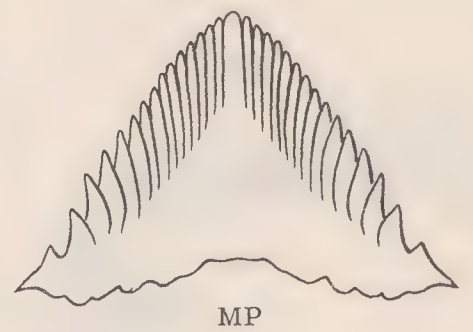
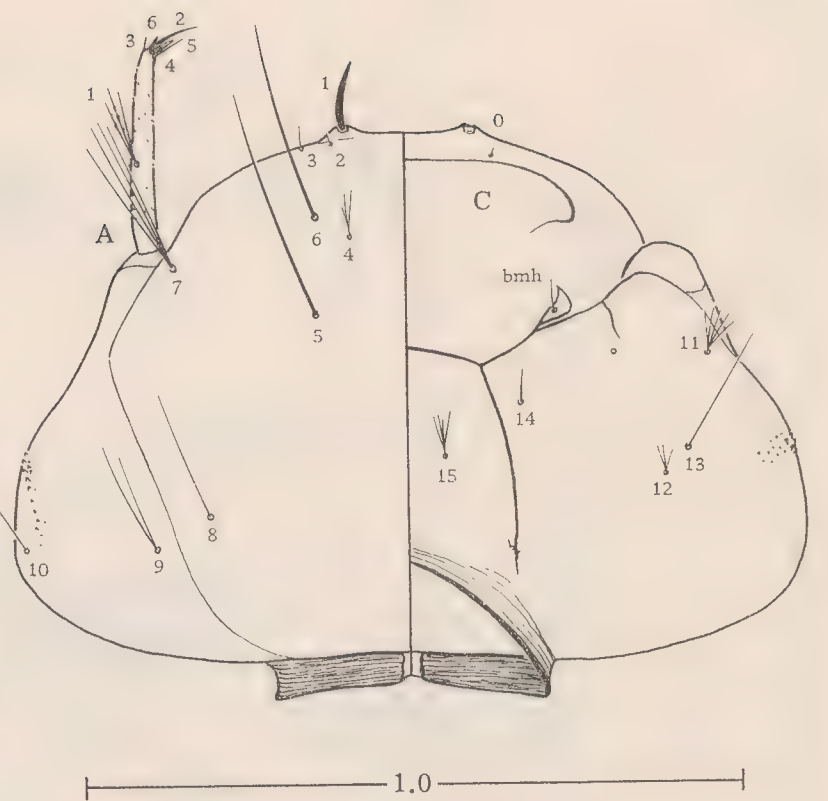
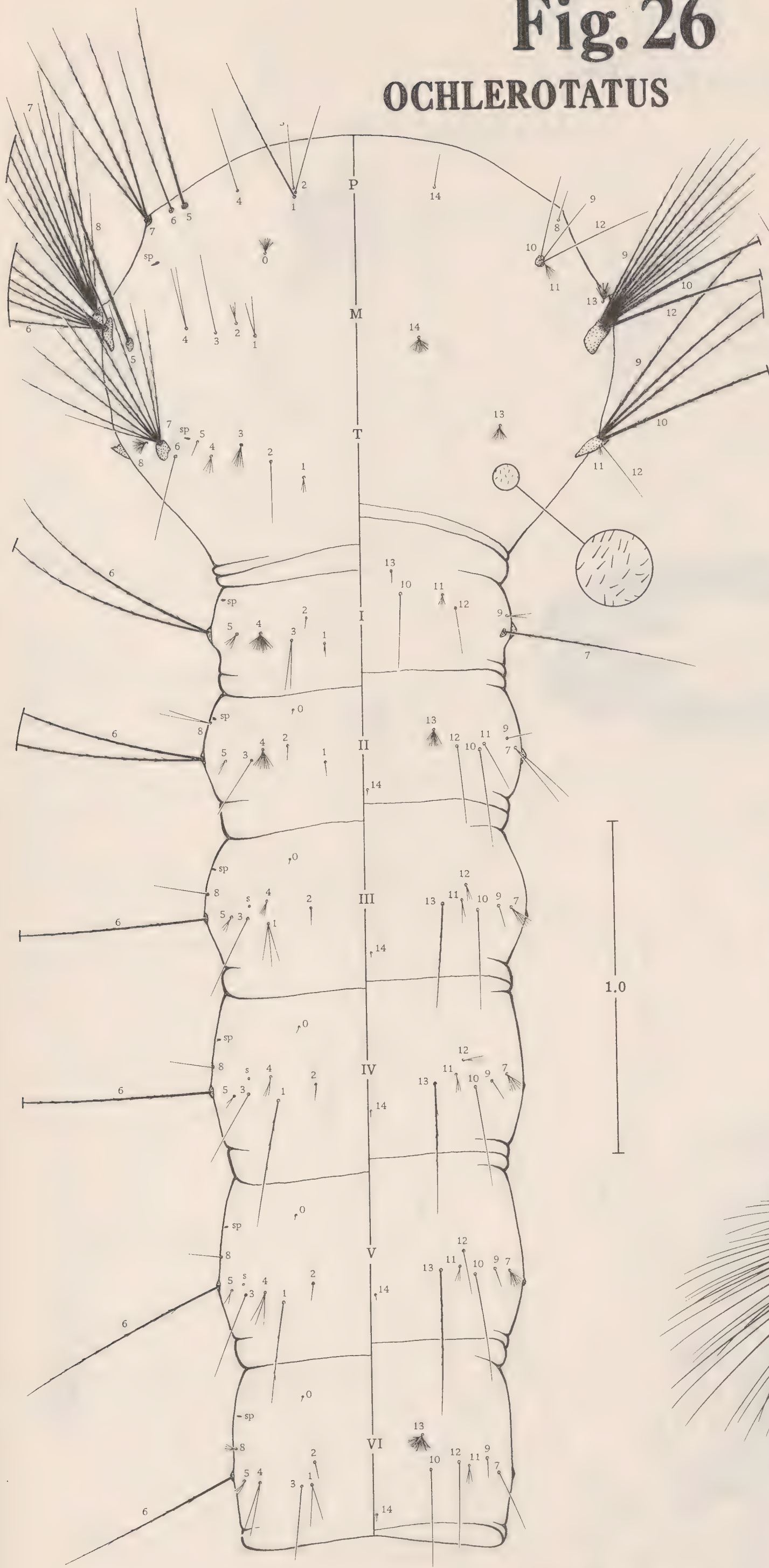
CR 309  
Alajuela  
Costa Rica





# Fig. 26

## OCHLEROTATUS



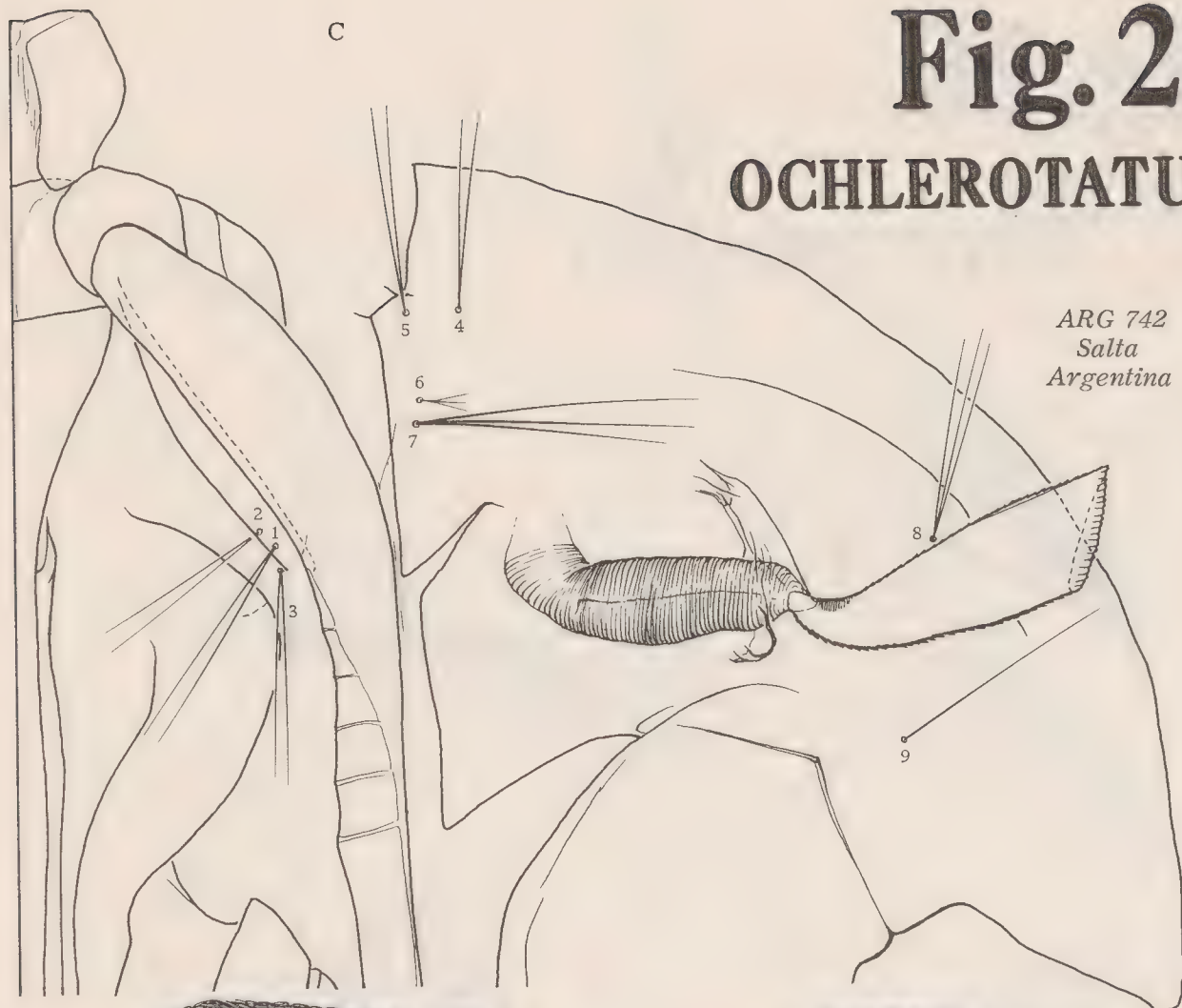
**euplocamus**

CR 309  
Alajuela  
Costa Rica

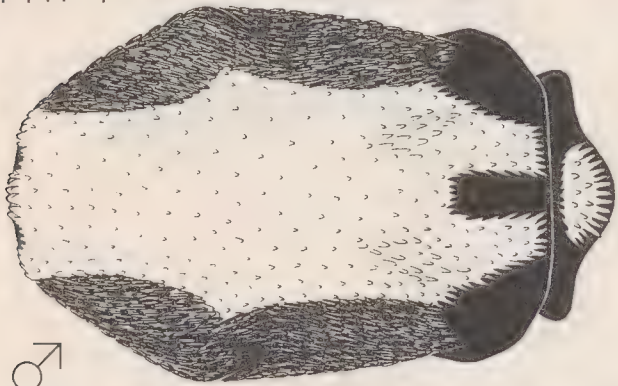


# Fig. 27

## OCHLEROTATUS



ARG 742  
Salta  
Argentina



♂

ARG 755



♀

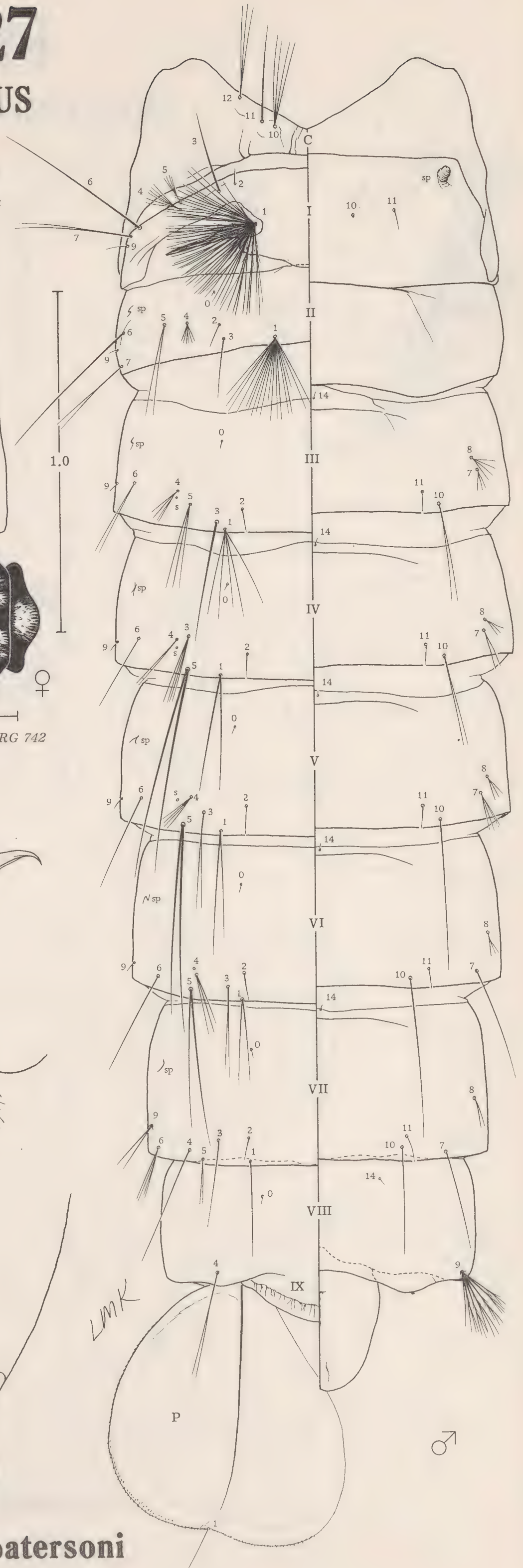
ARG 742

1.0



ARG 755  
Salta  
Argentina

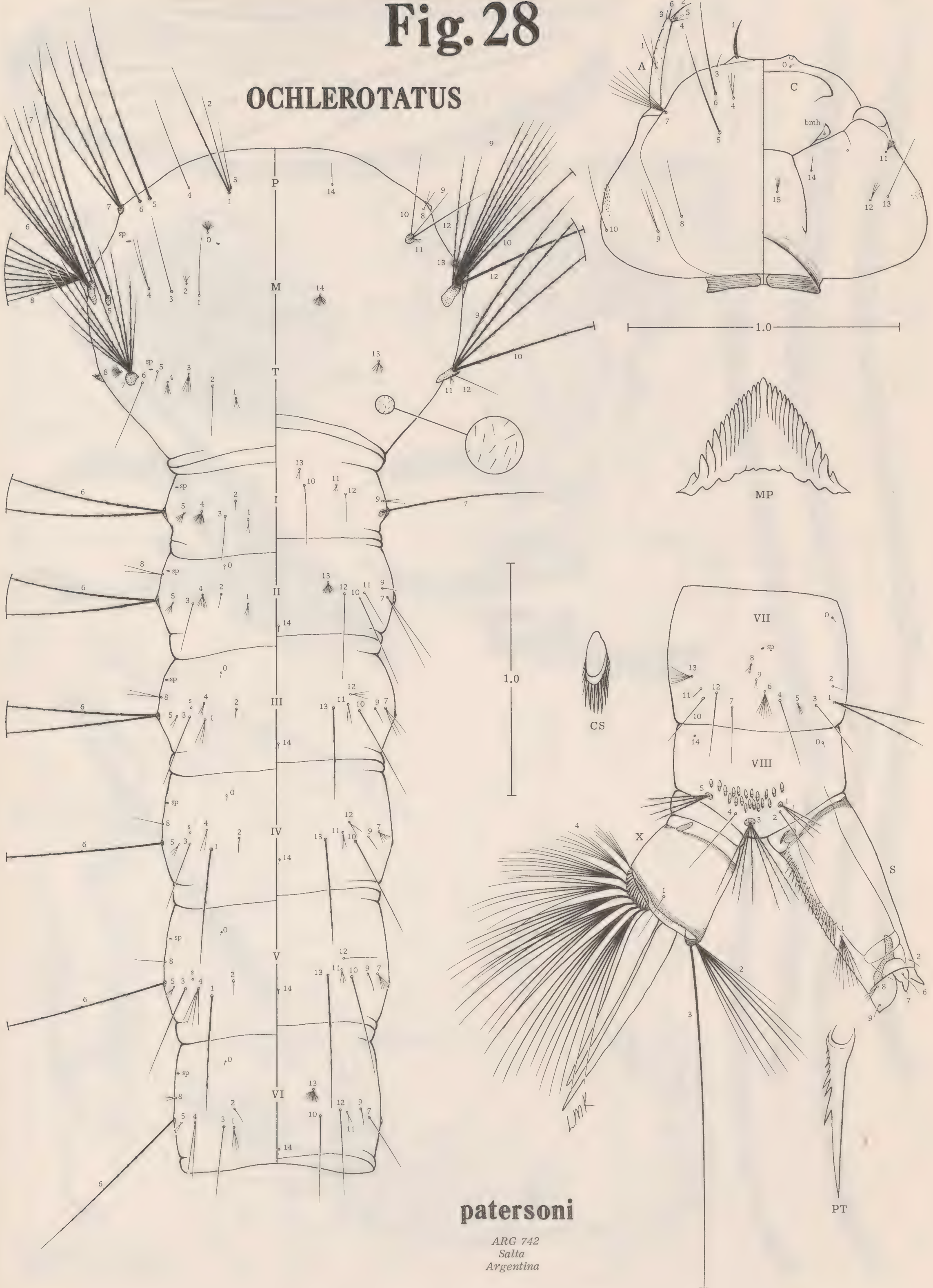
patersoni





# Fig. 28

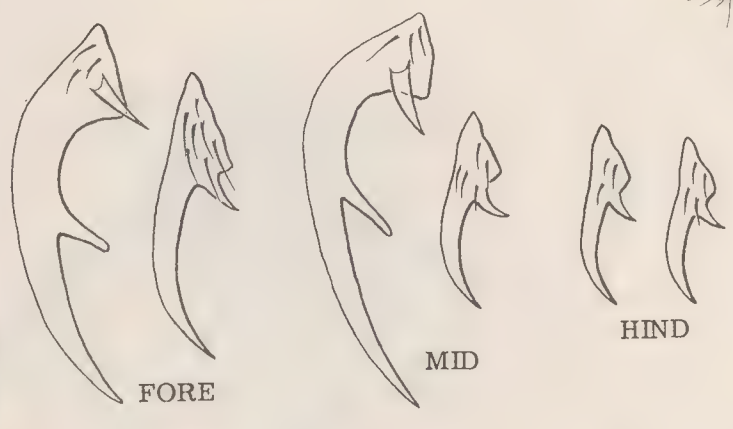
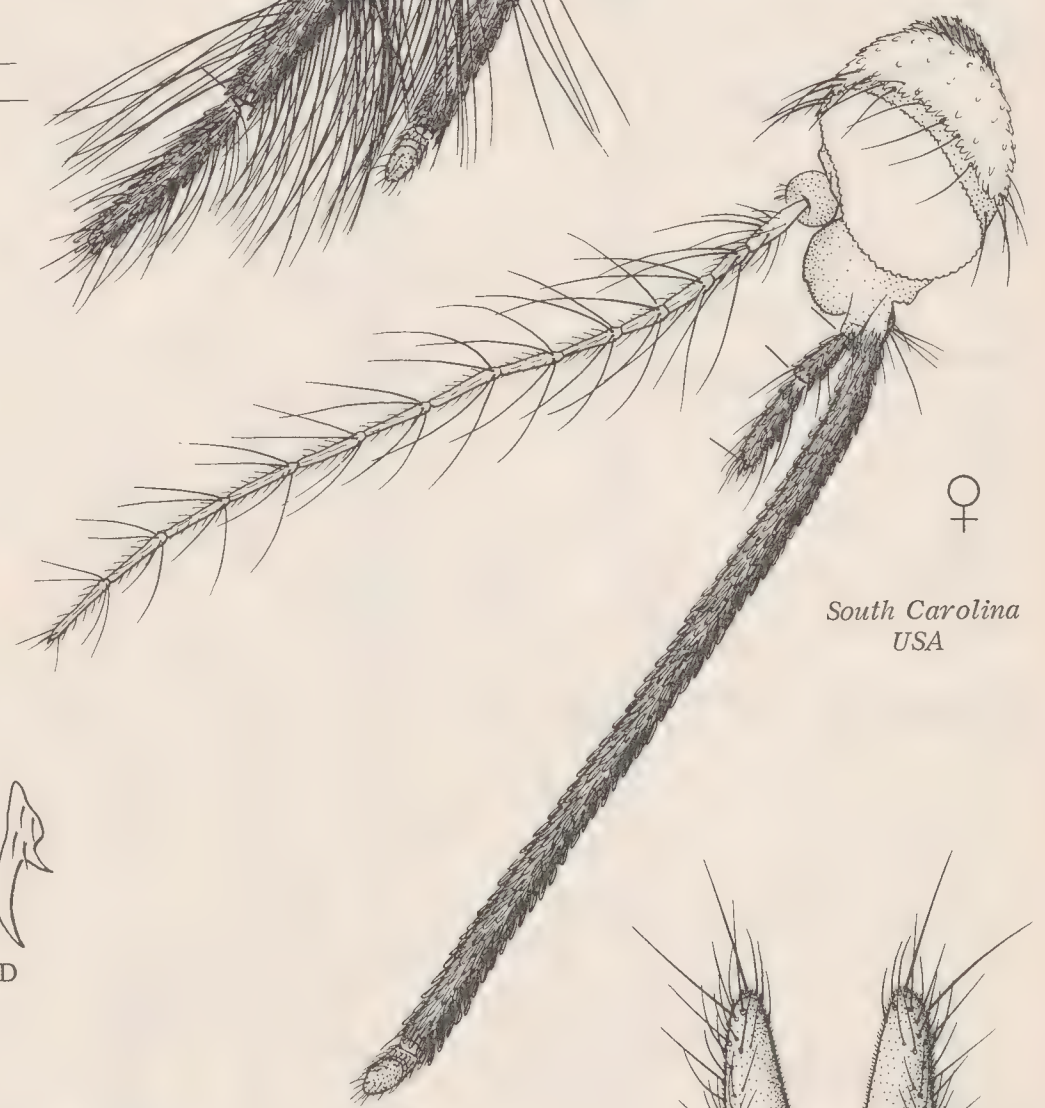
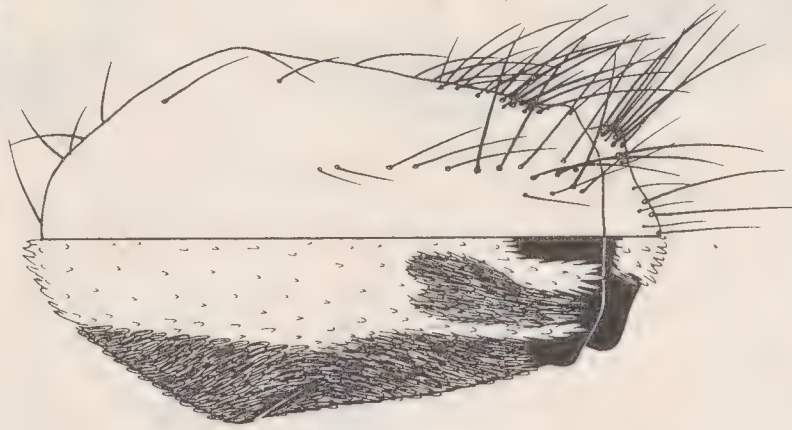
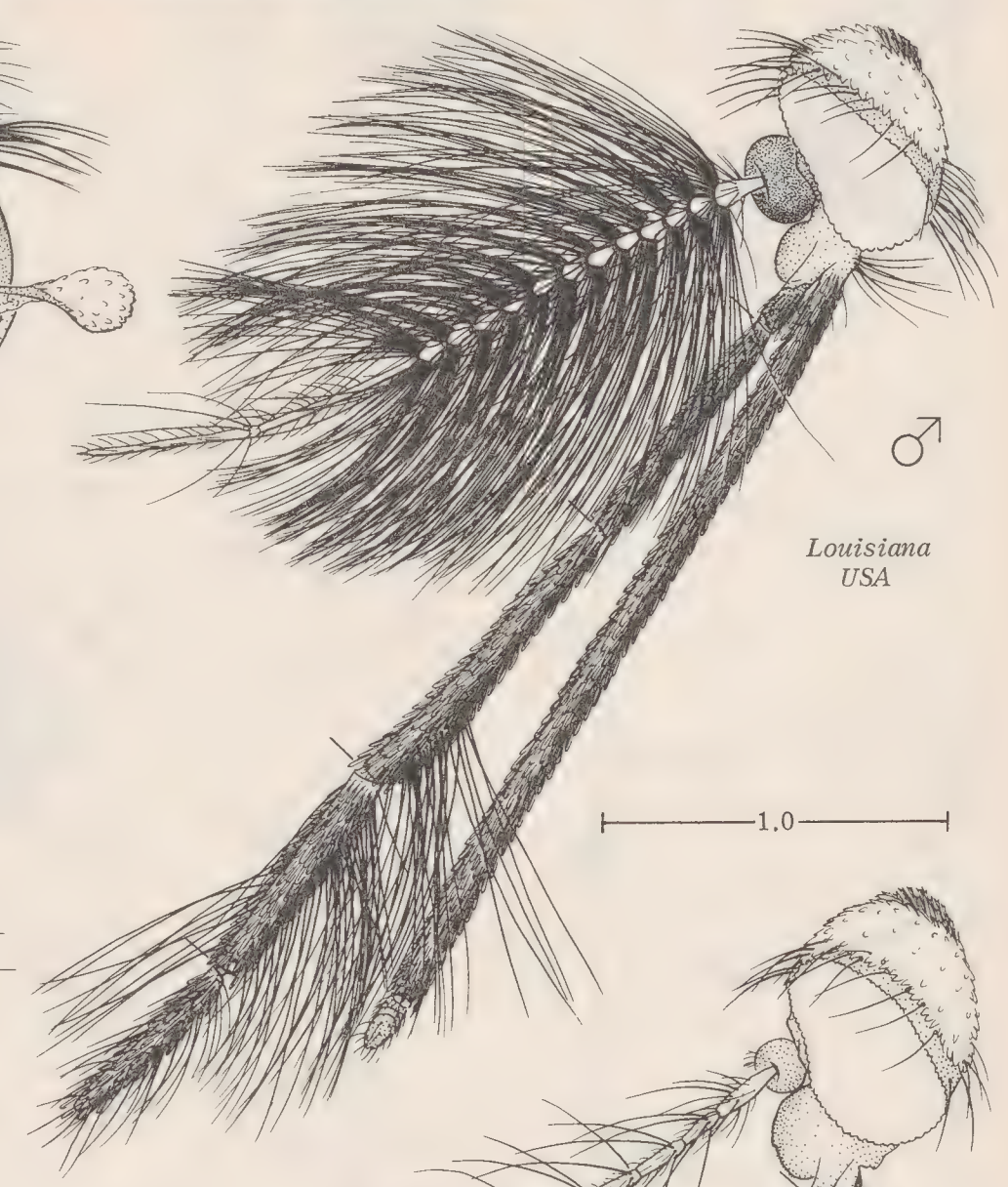
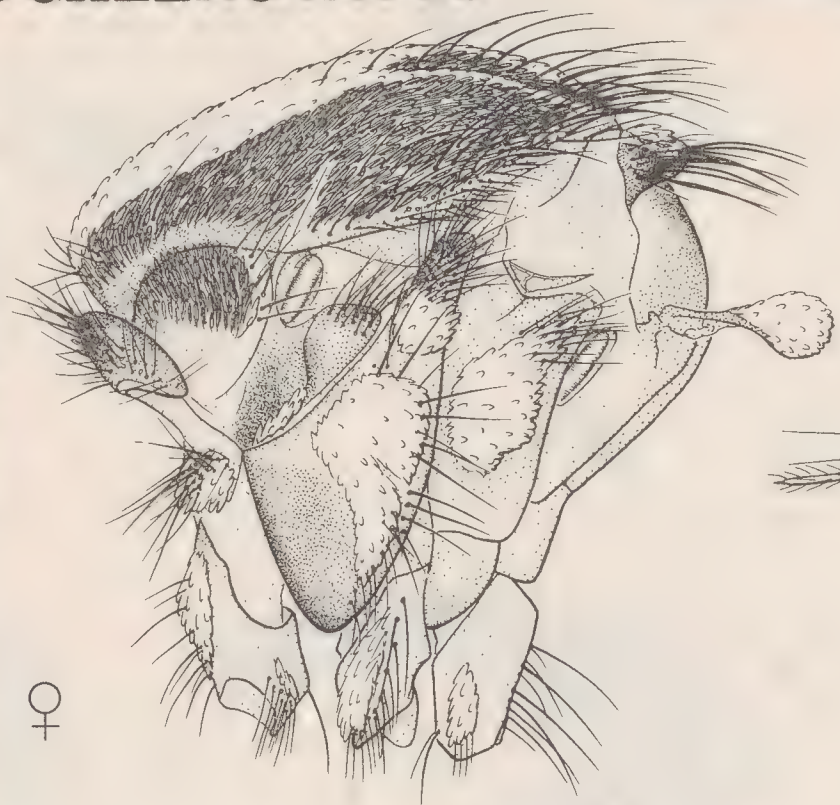
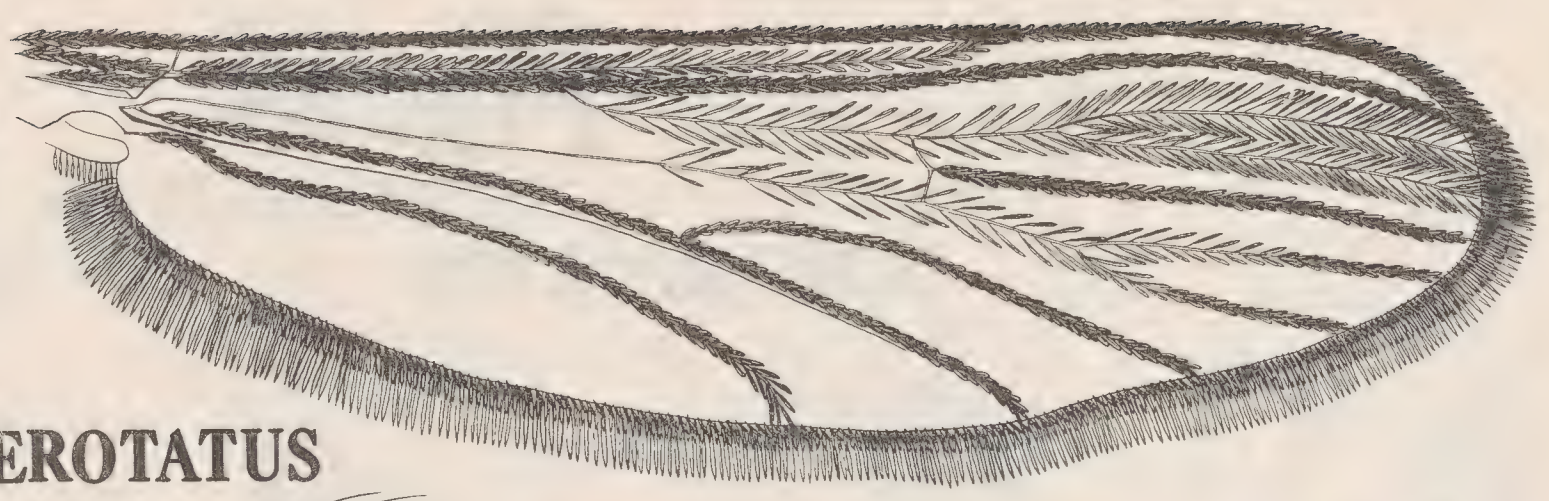
## OCHLEROTATUS





**Fig.  
29**

**OCHLEROTATUS**



**infirmatus**

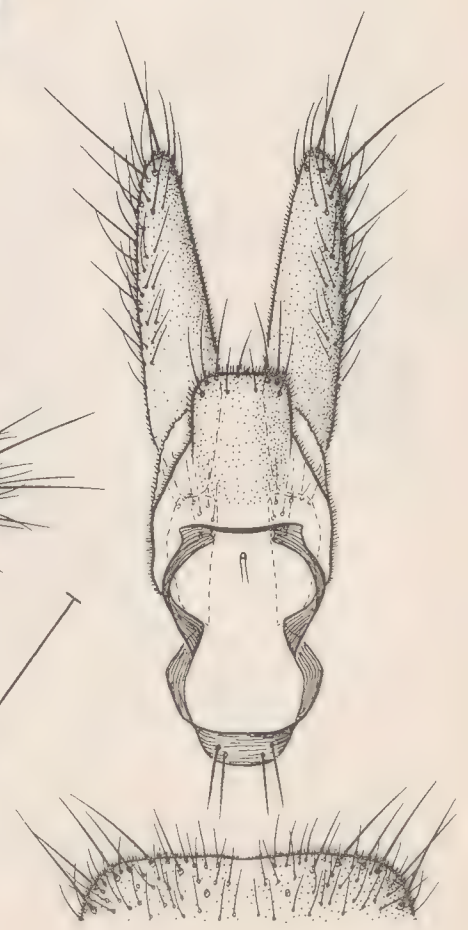
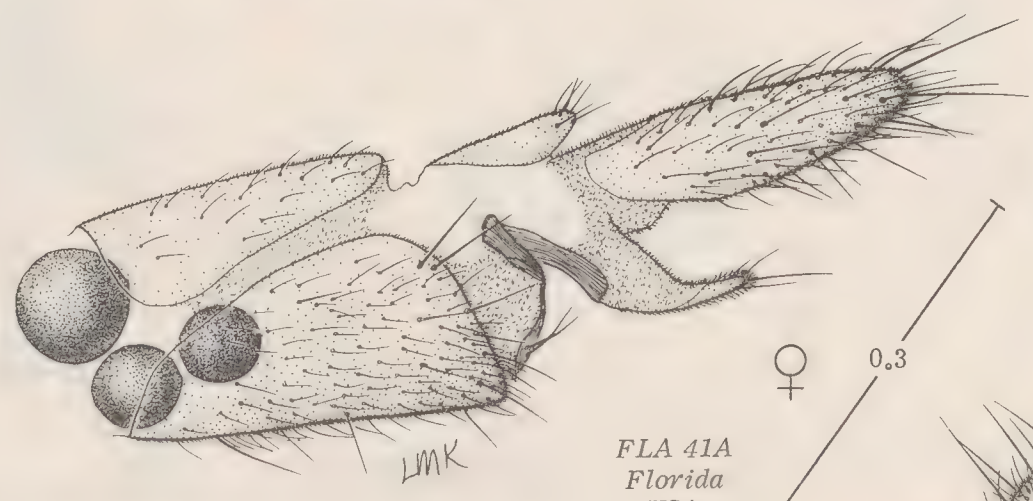
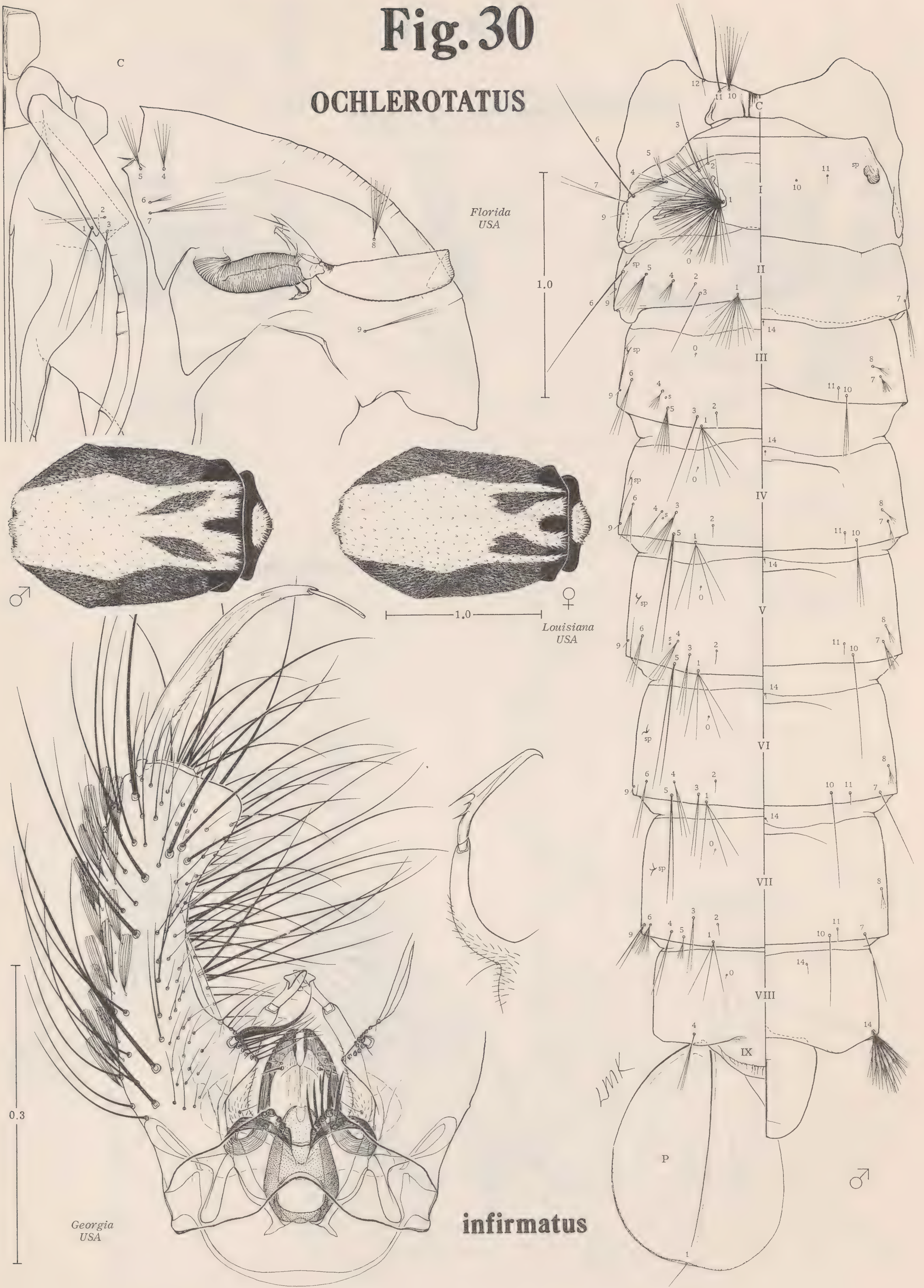




Fig. 30

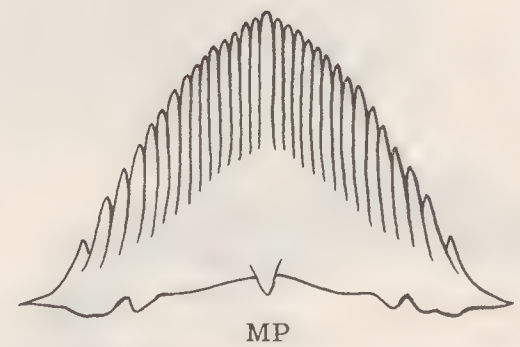
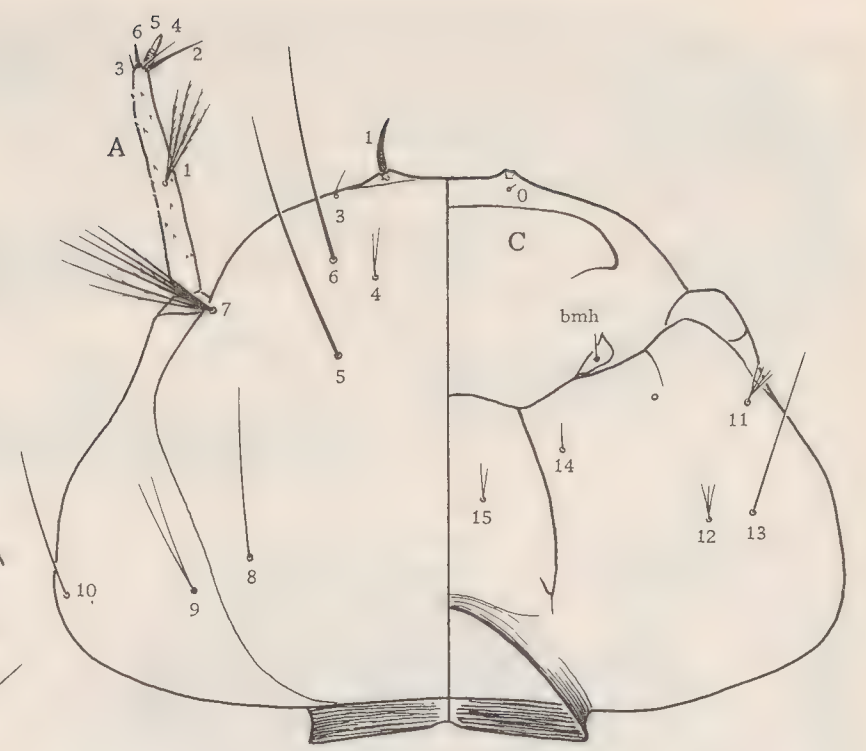
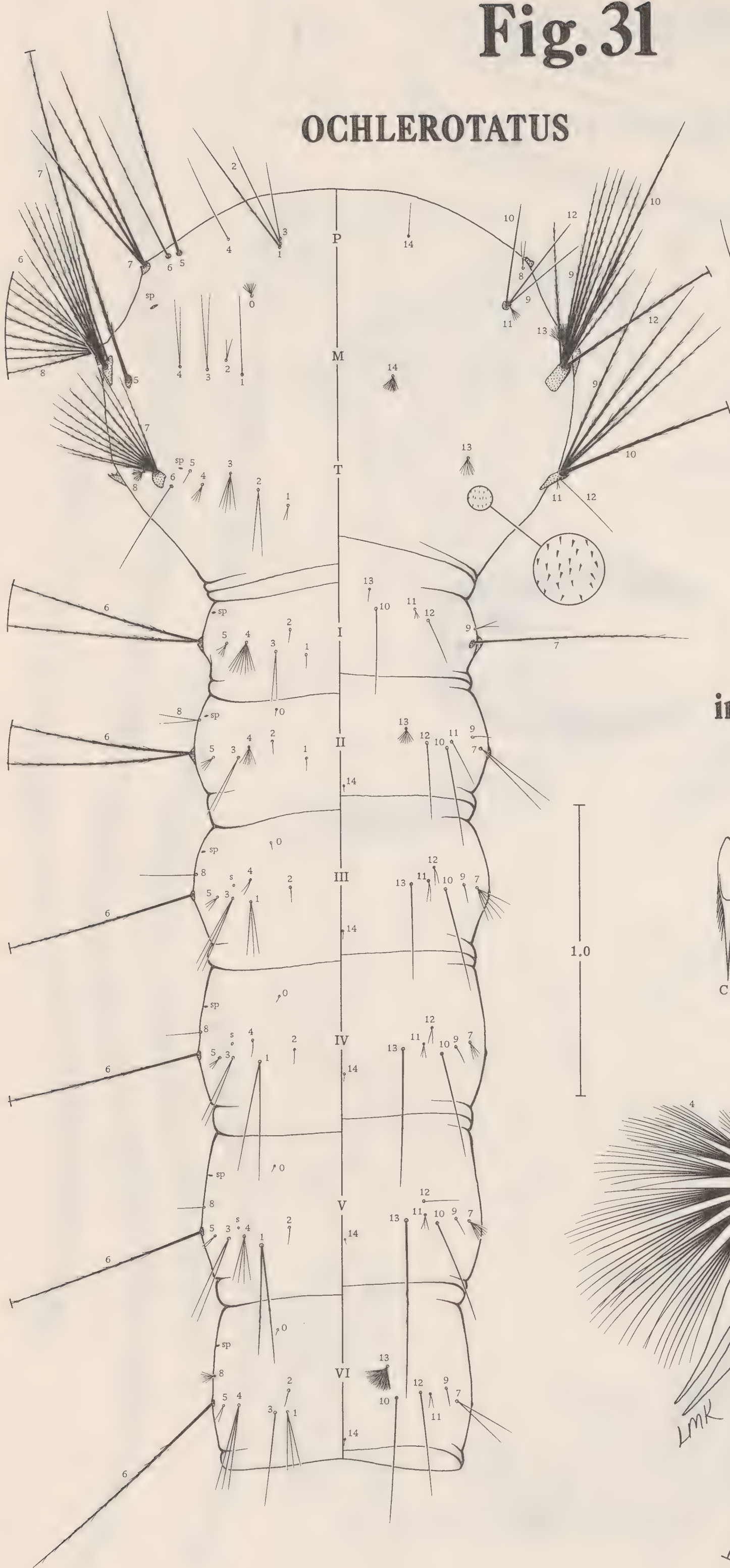
OCHLEROTATUS





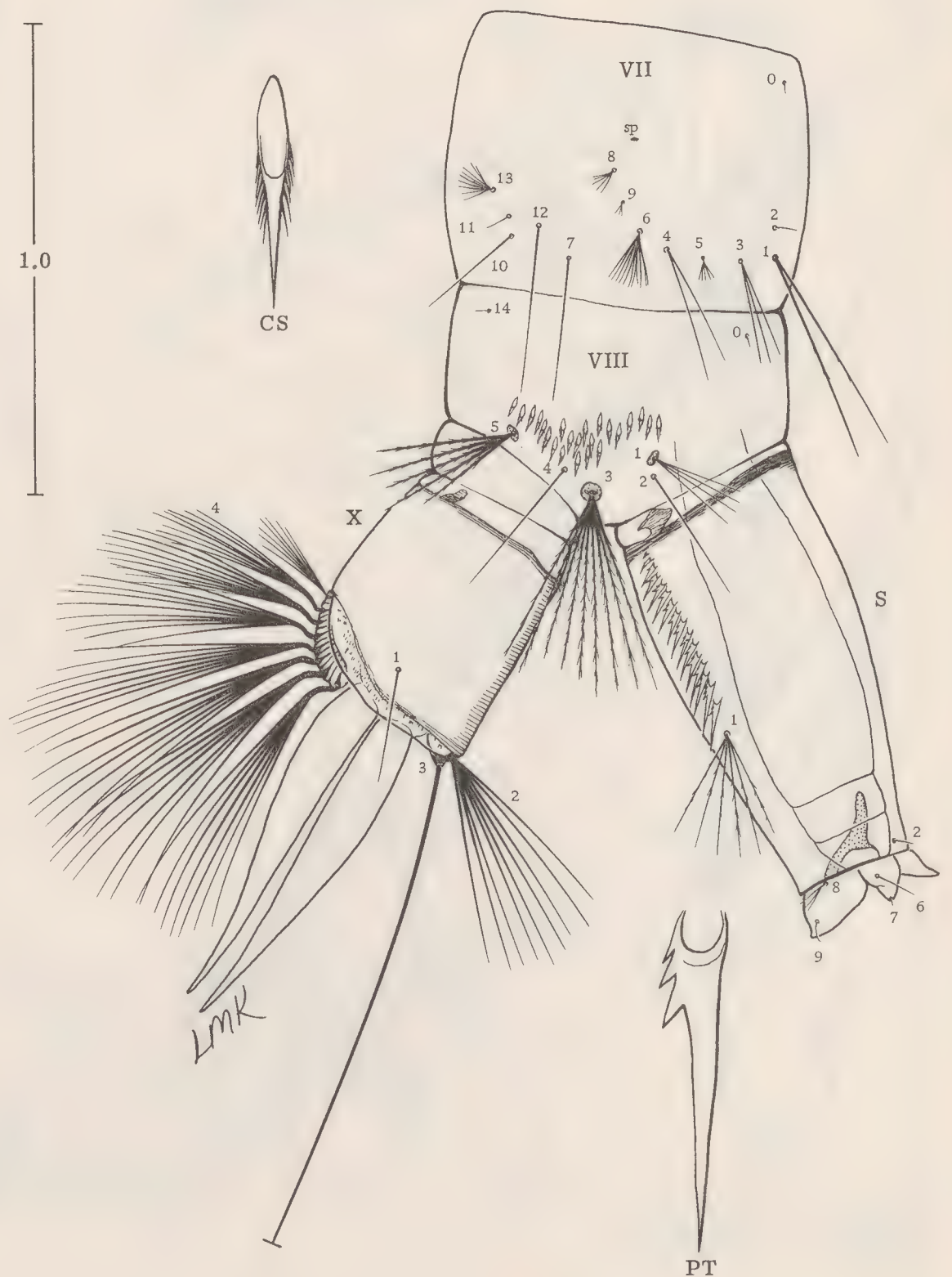
# Fig. 31

## OCHLEROTATUS



## infirmatus

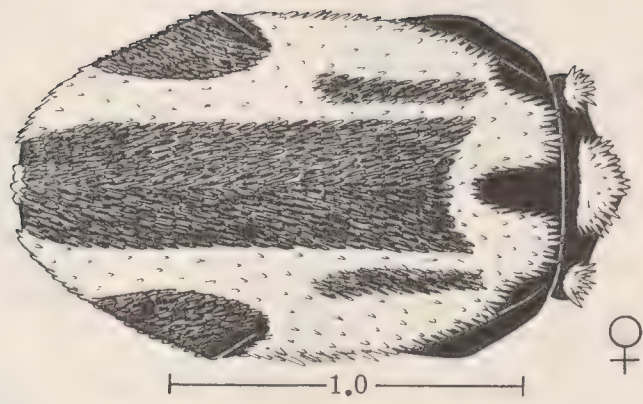
Florida  
USA





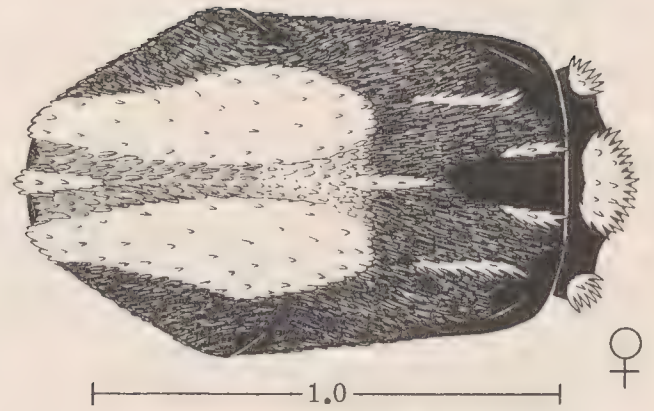
# Fig. 32

## OCHLEROTATUS



**meprai**

*Salta*  
*Argentina*



**raymondi**

*Jujuy*  
*Argentina*



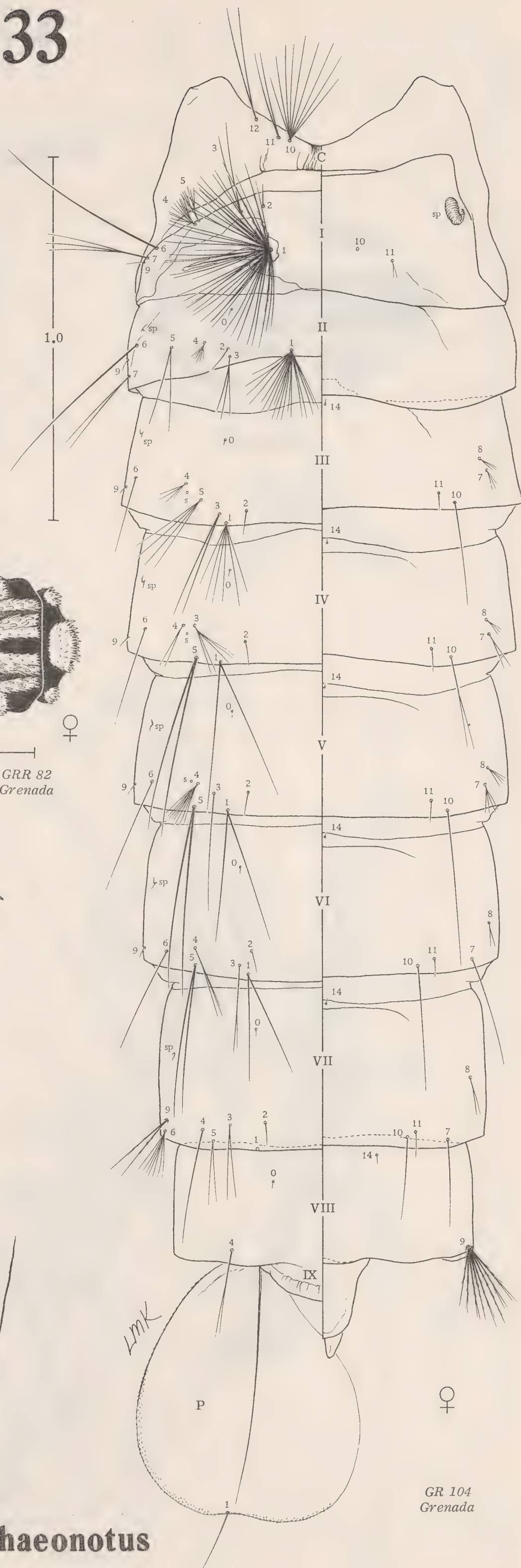
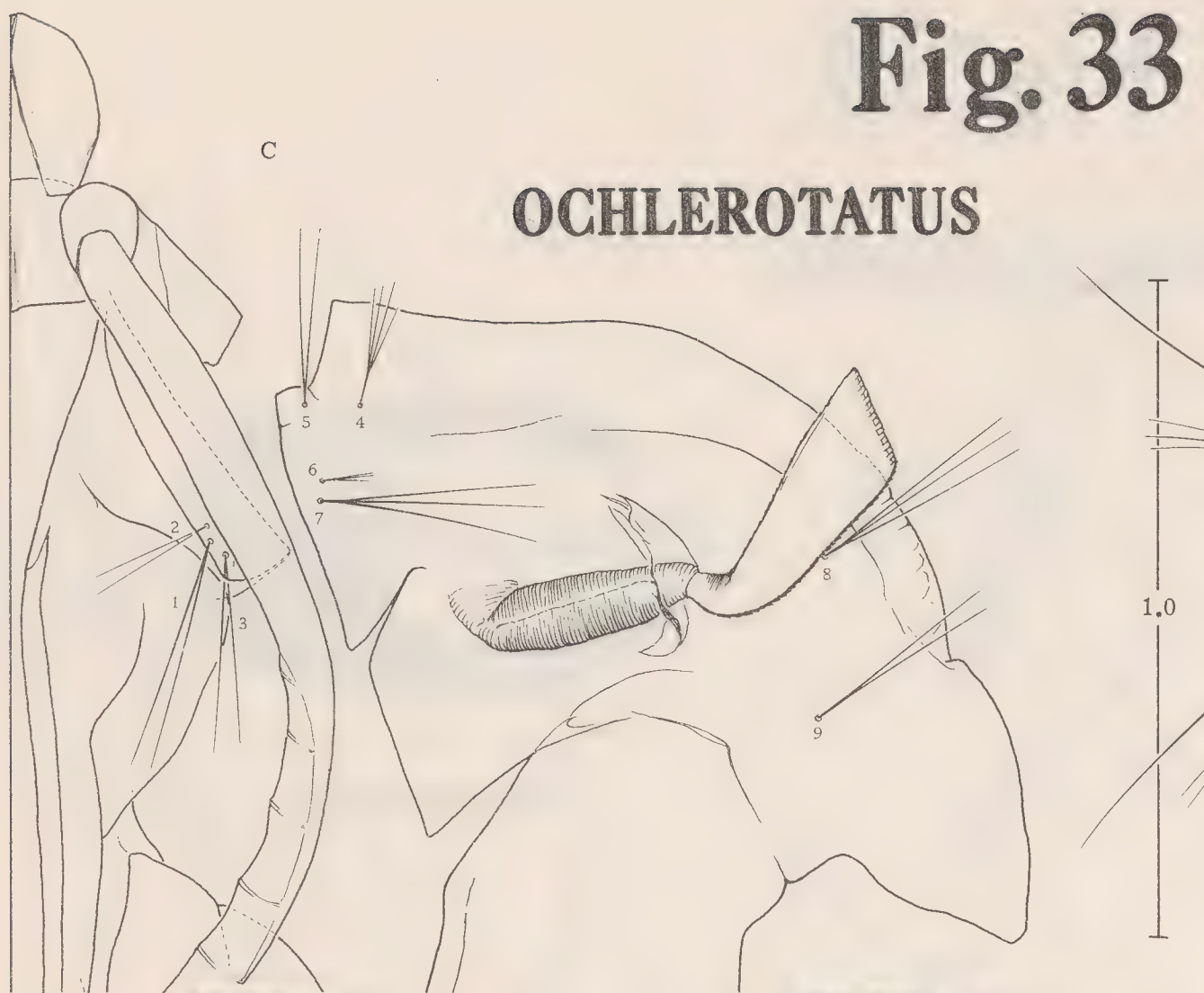
**comitatus**

*KO 200-2*  
*Meta*  
*Colombia*



# Fig. 33

## OCHLEROTATUS



## phaeonotus

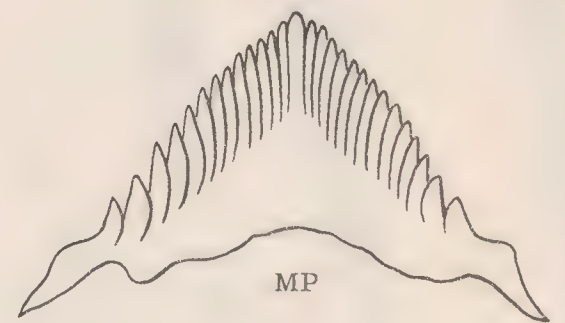
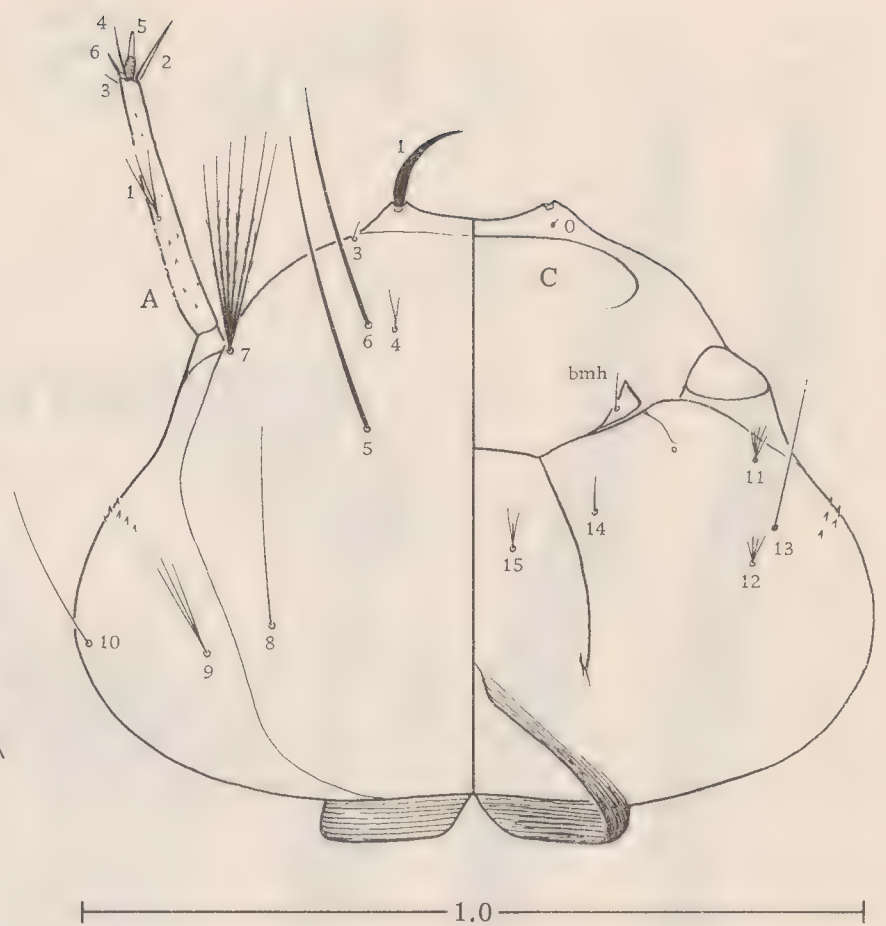
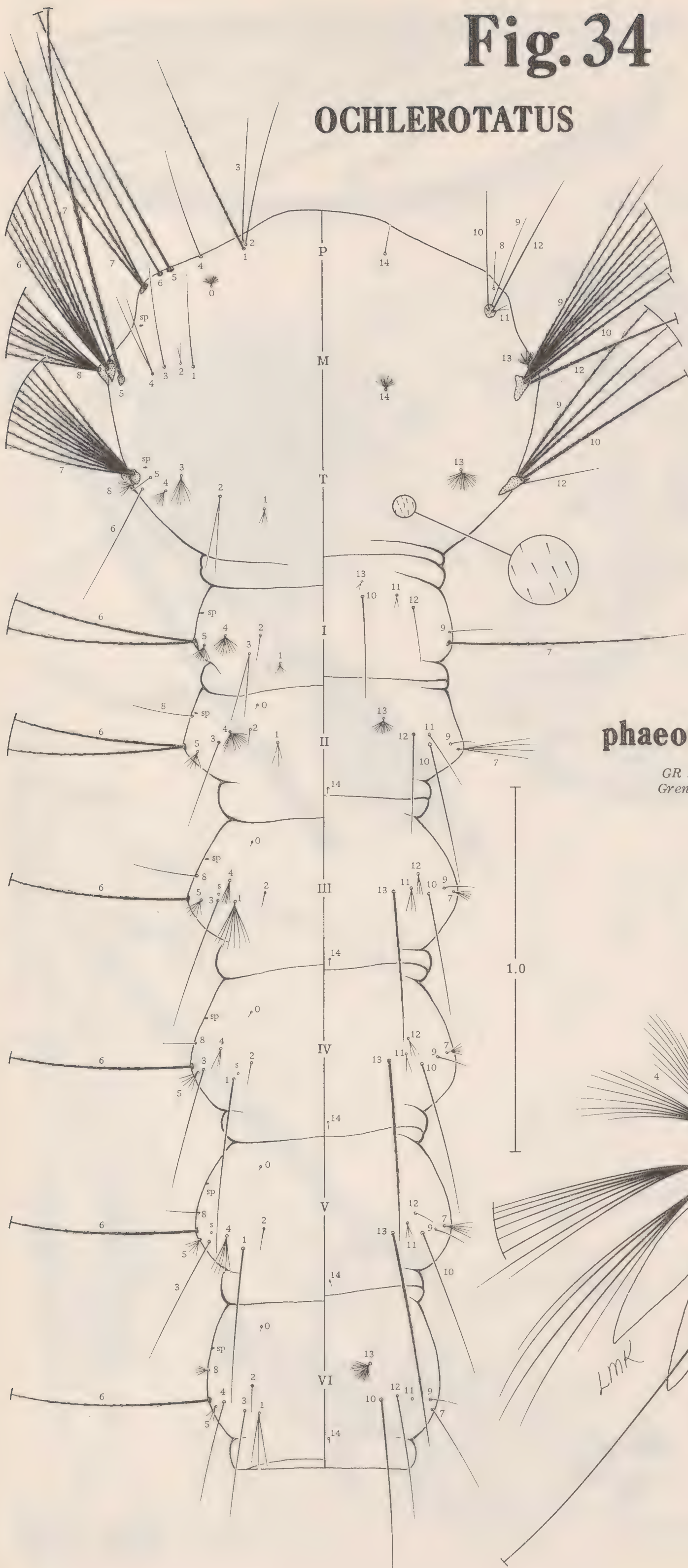
GRR 82  
Grenada

GR 104  
Grenada



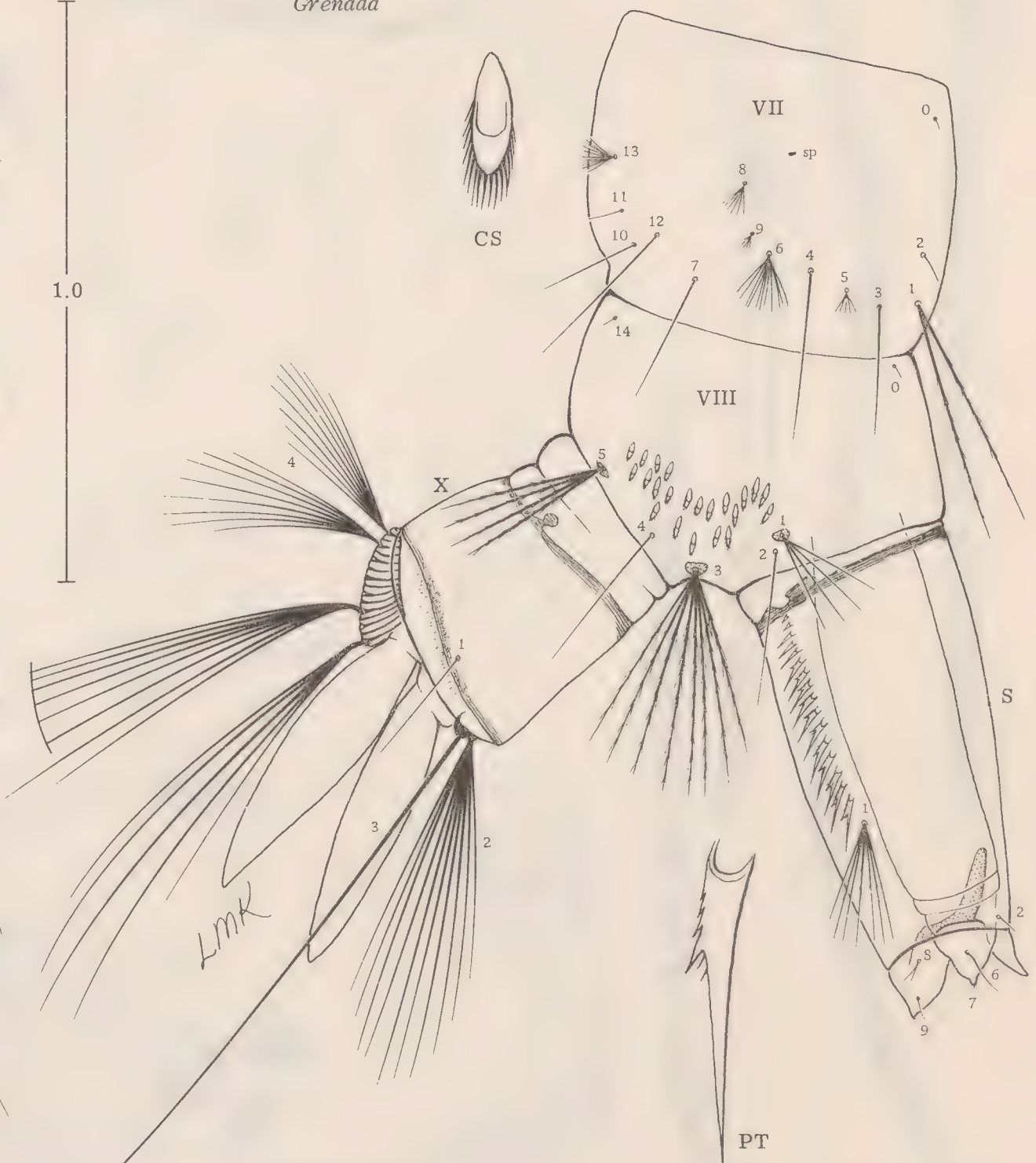
# Fig. 34

## OCHLEROTATUS



## phaeonotus

GR 104  
Grenada





FORE MID HIND

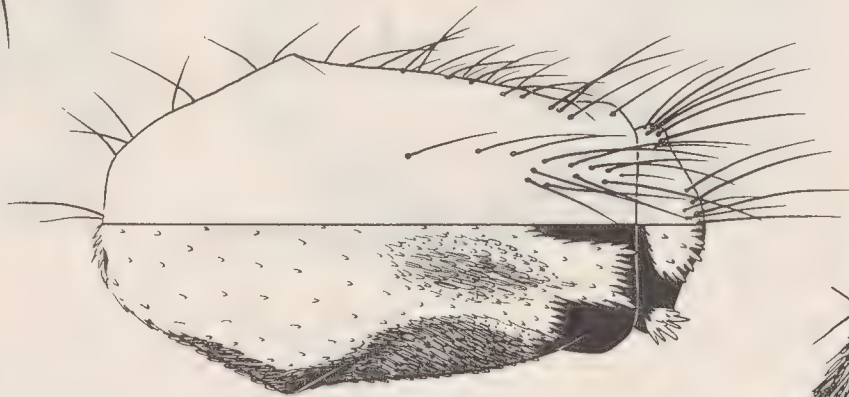
**Fig. 35**

**OCHLEROTATUS**

1.0

JA 799  
Jamaica

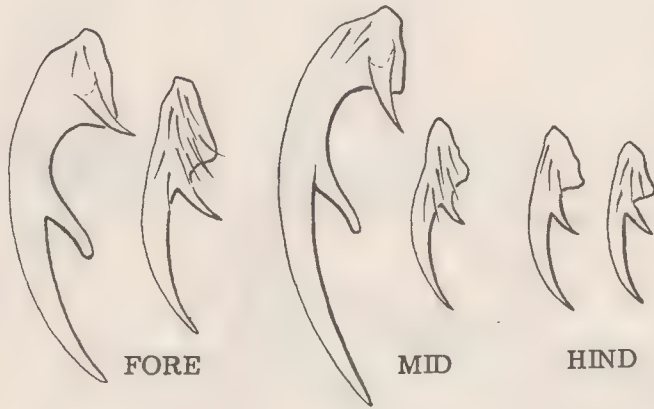
♀



FORE MID HIND

♀

0.1



♂

**scapularis**

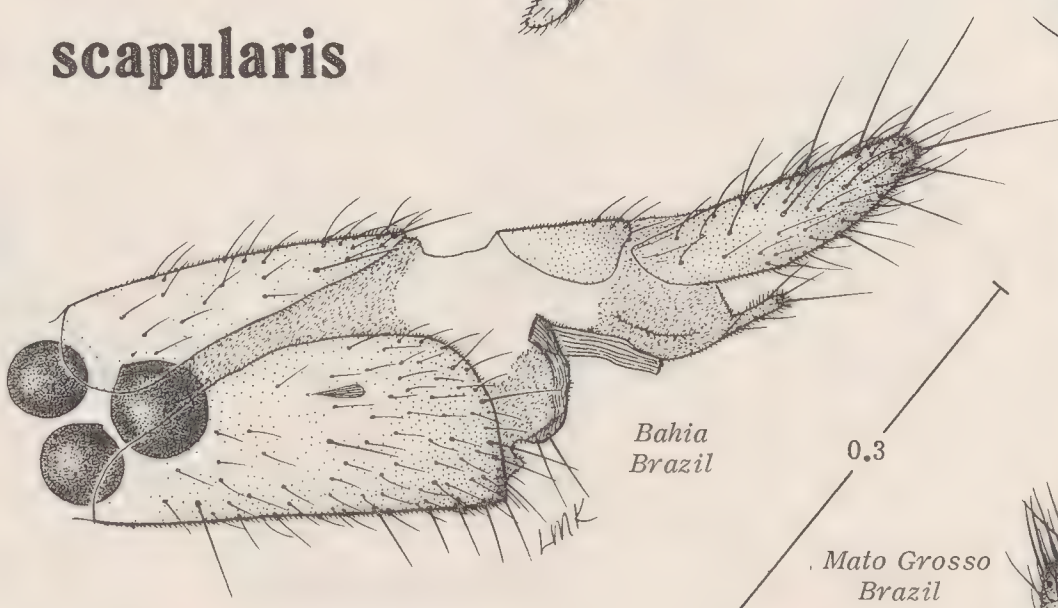
0.1



Bahia  
Brazil

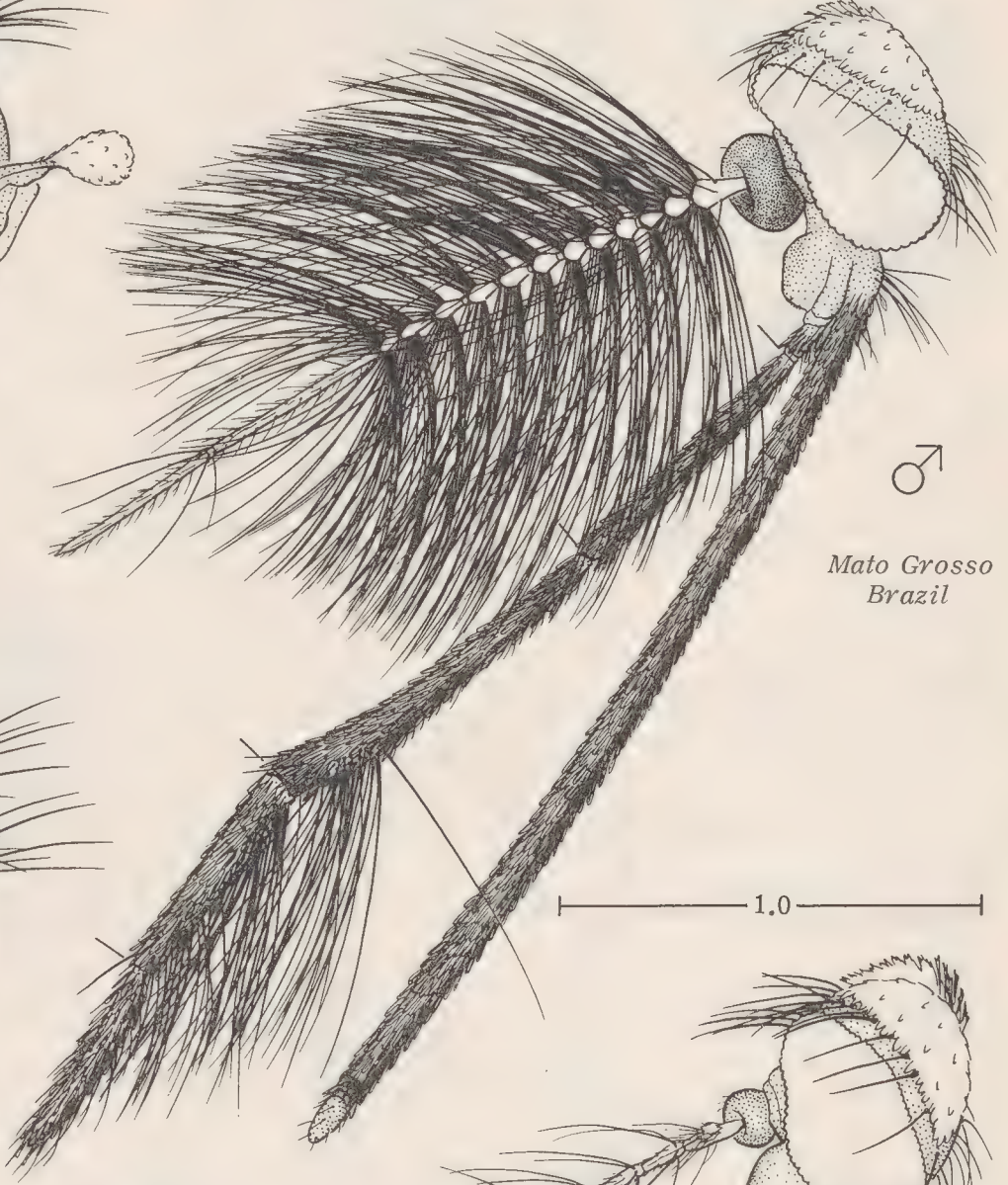
0.3

Mato Grosso  
Brazil



♂

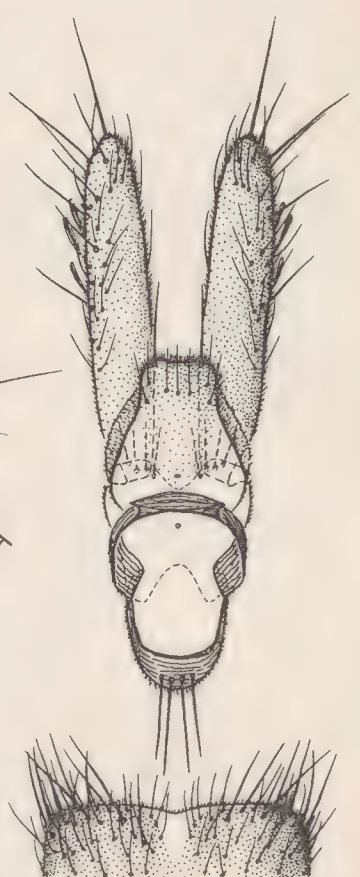
Mato Grosso  
Brazil



1.0

♀

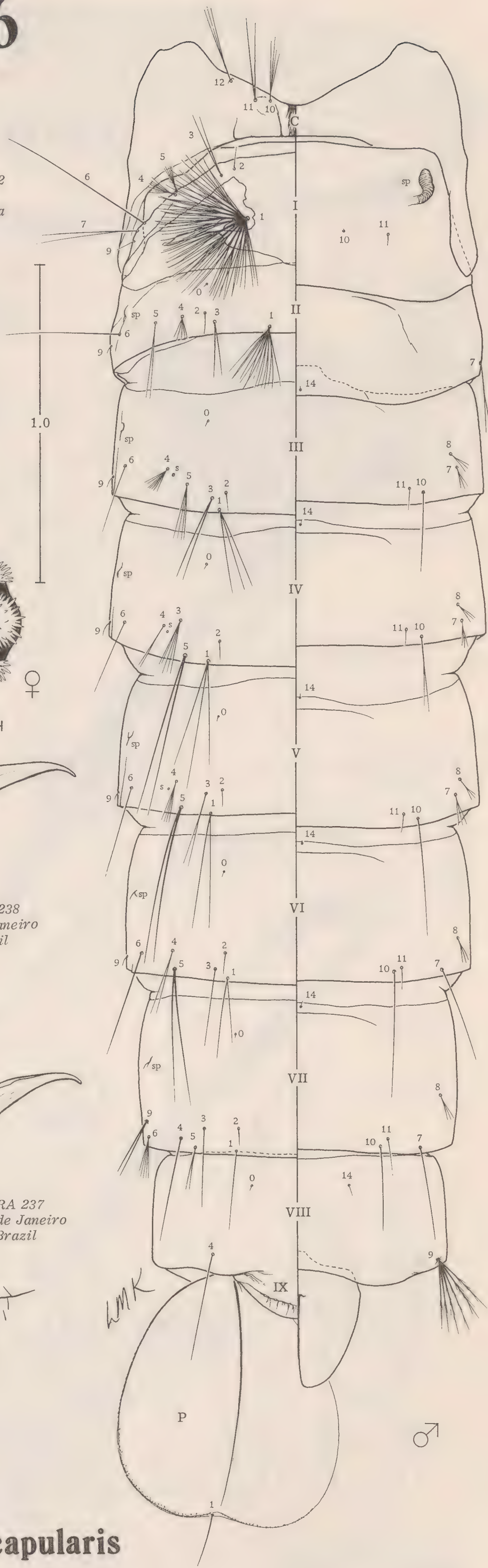
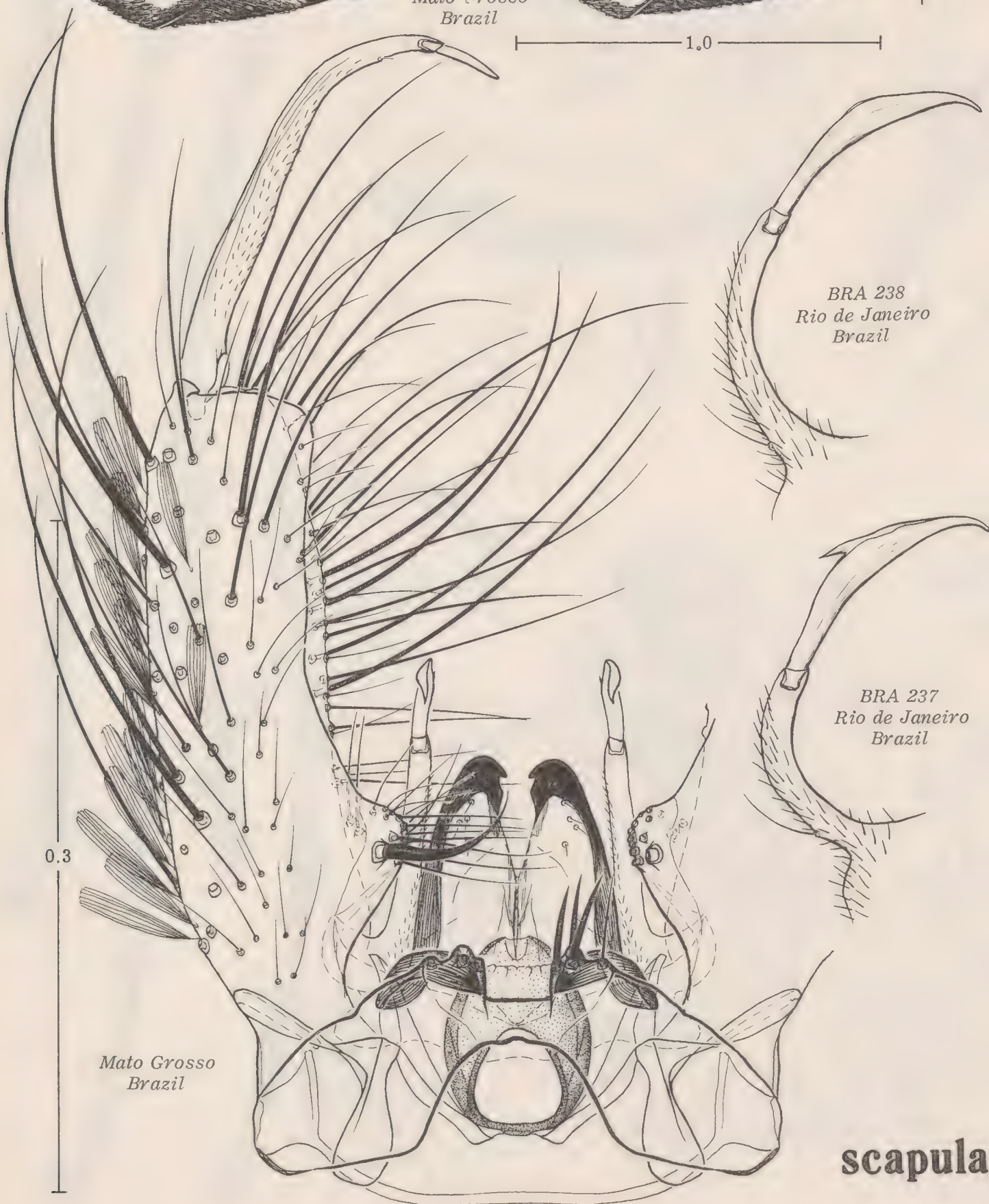
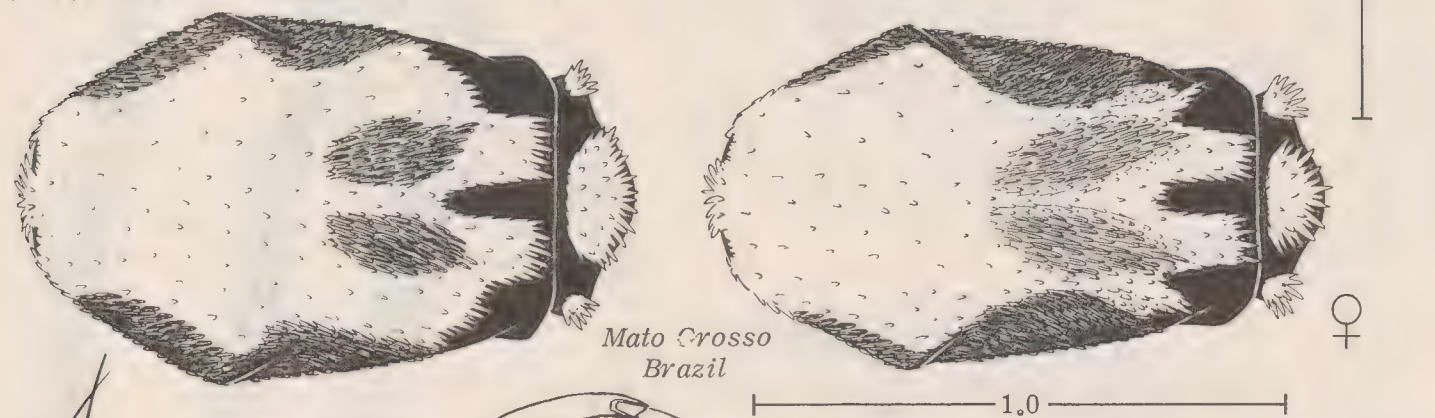
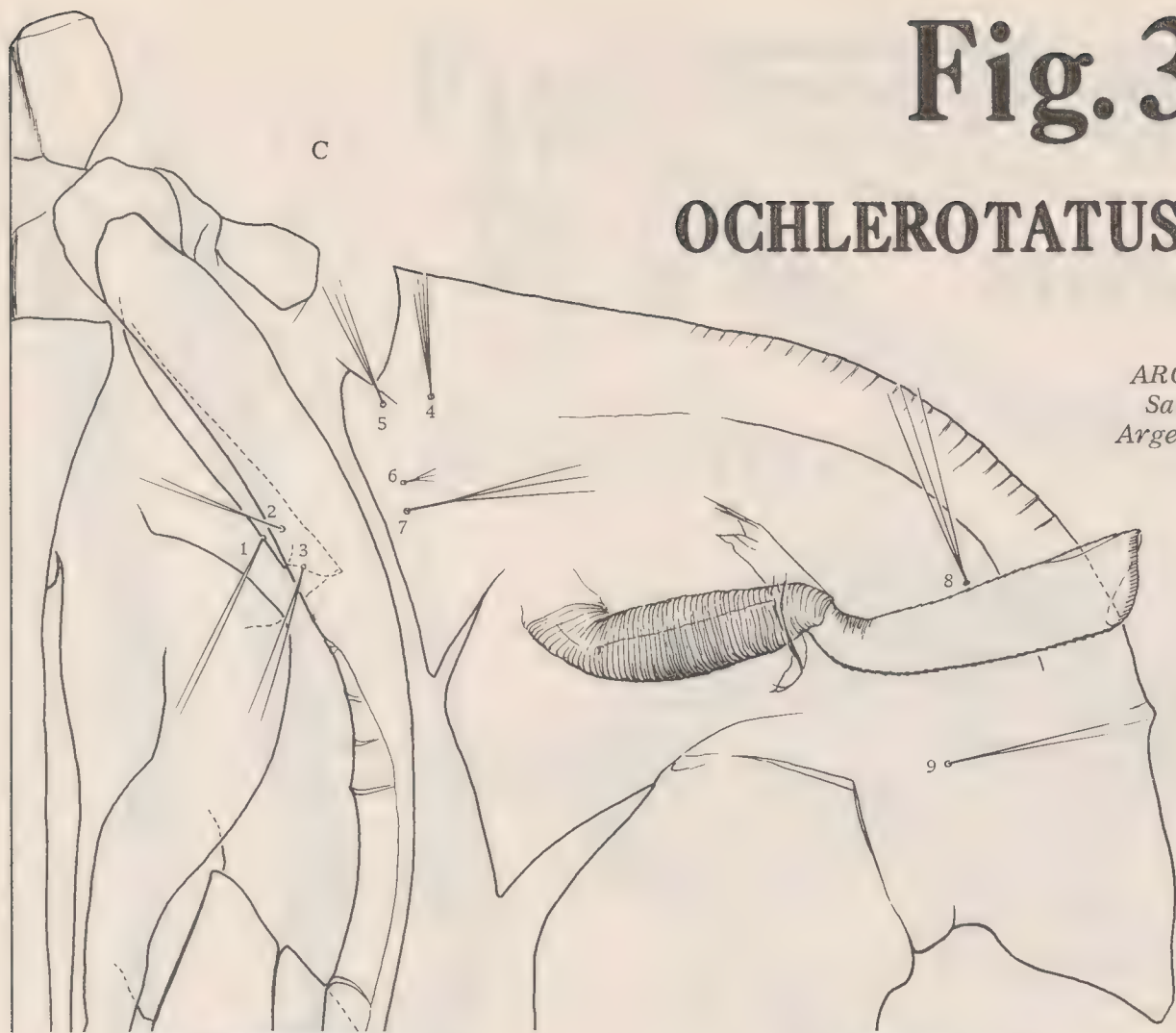
Mato Grosso  
Brazil





# Fig. 36

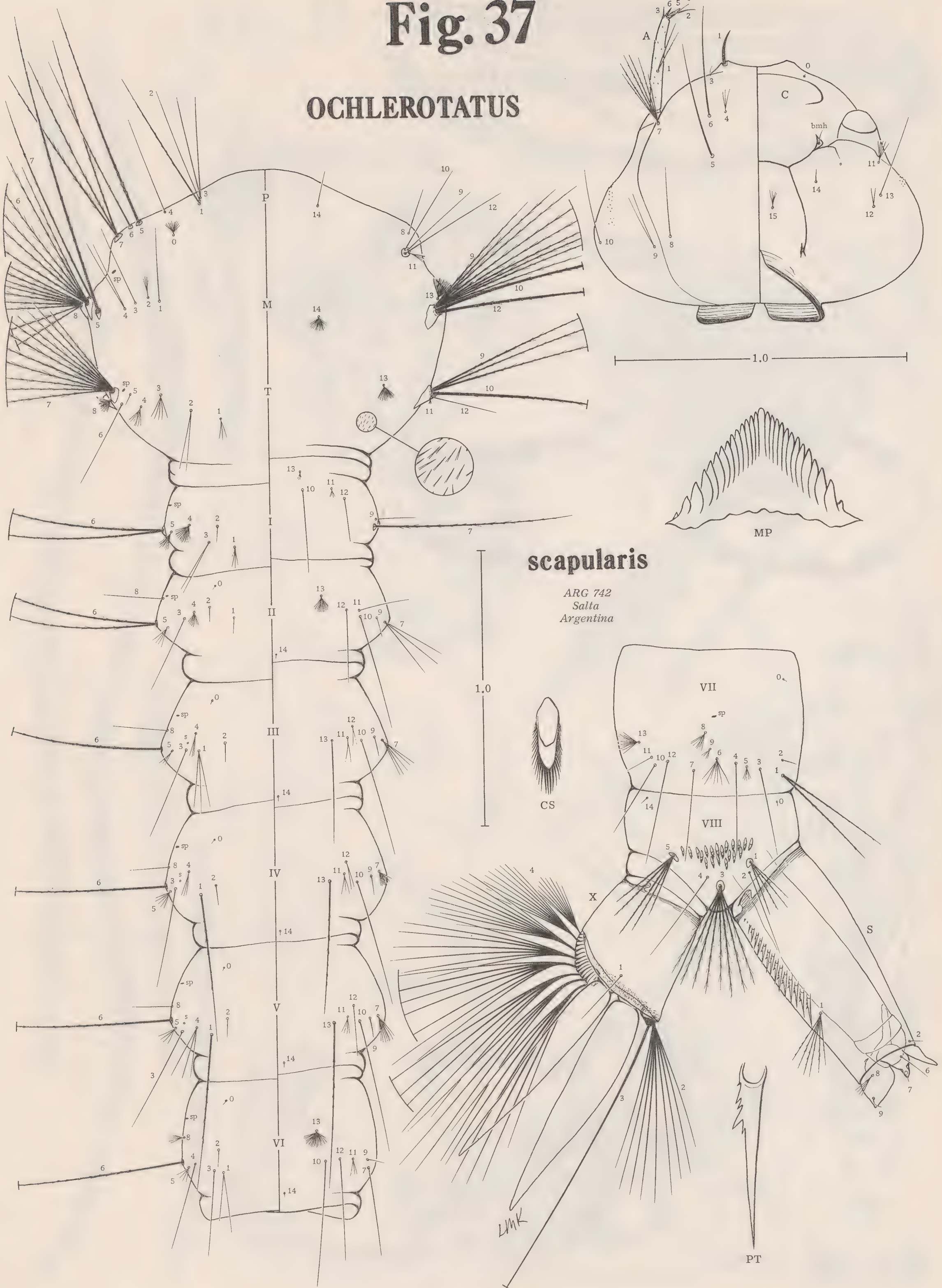
## OCHLEROTATUS





# Fig. 37

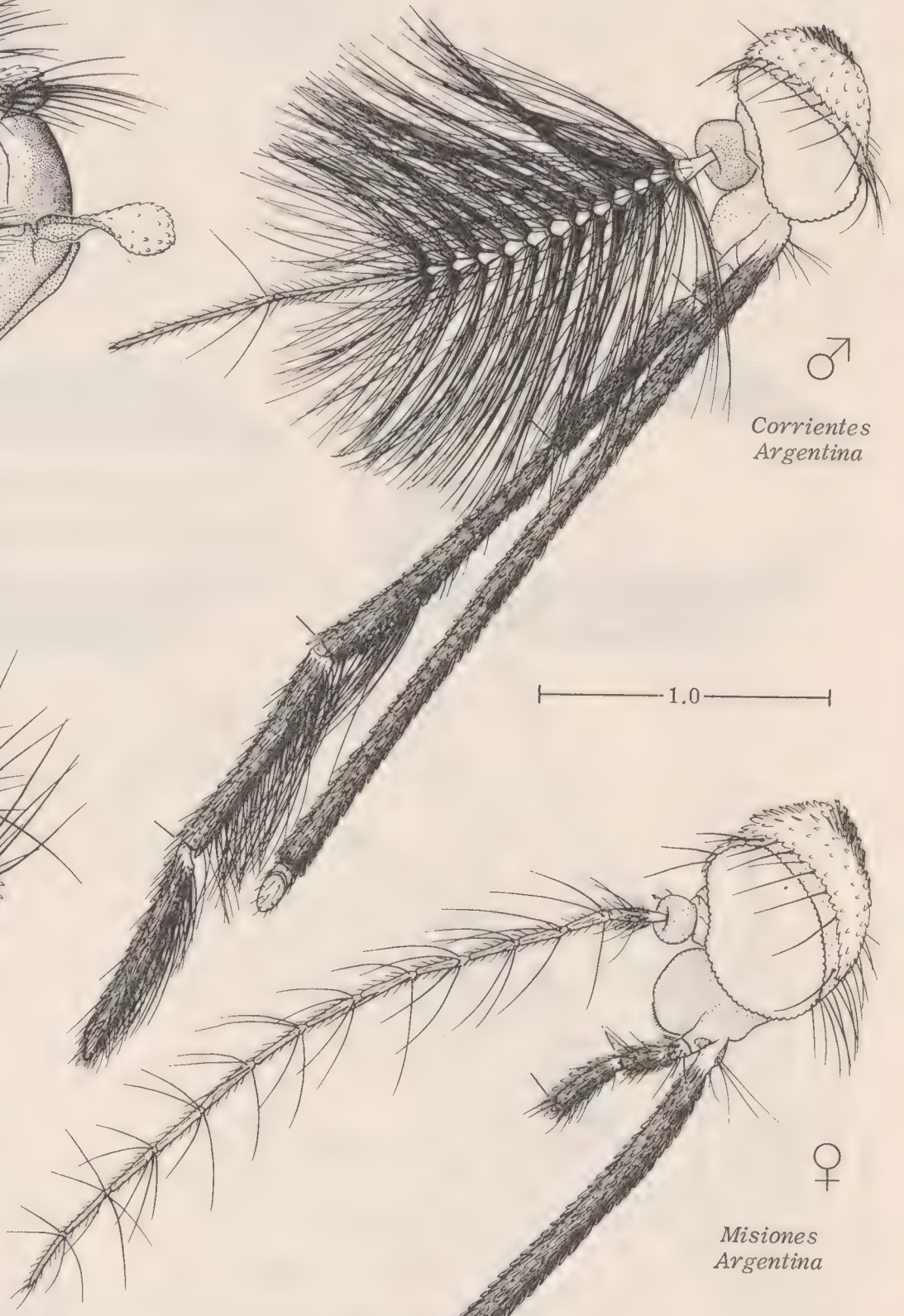
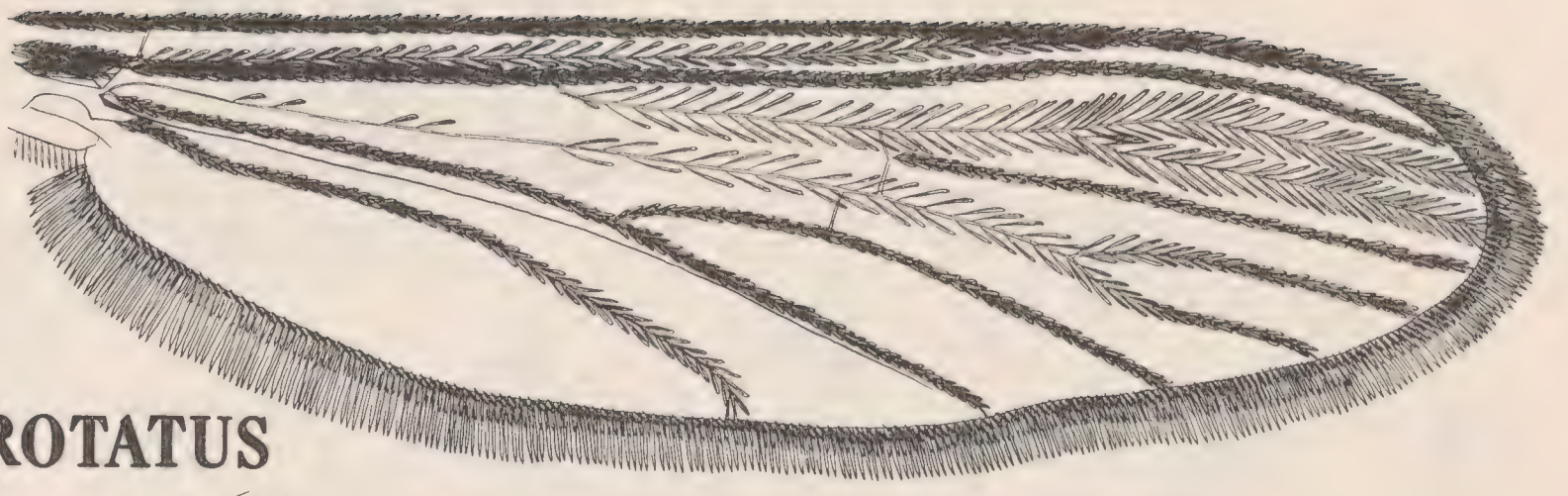
## OCHLEROTATUS





**Fig.  
38**

**OCHLEROTATUS**

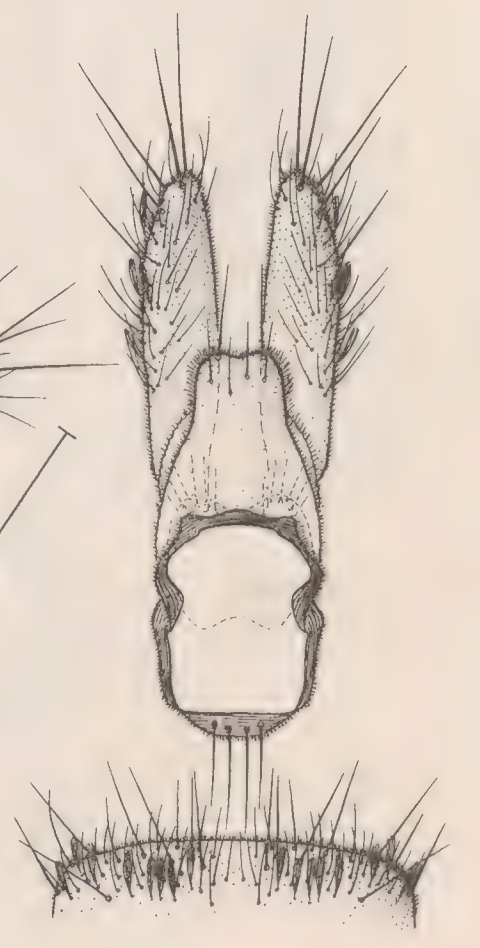


*Corrientes  
Argentina*

*Misiones  
Argentina*



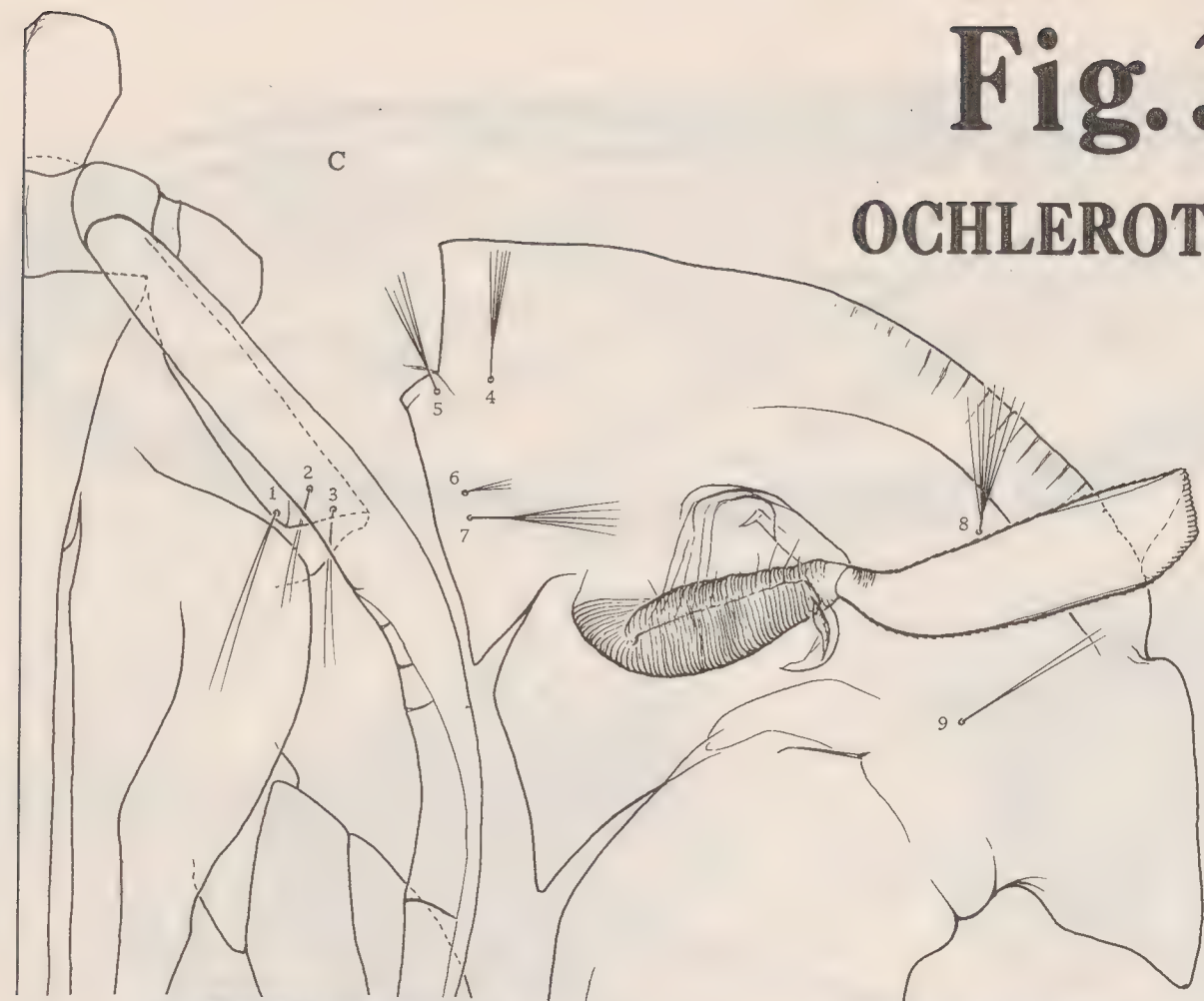
**crinifer**





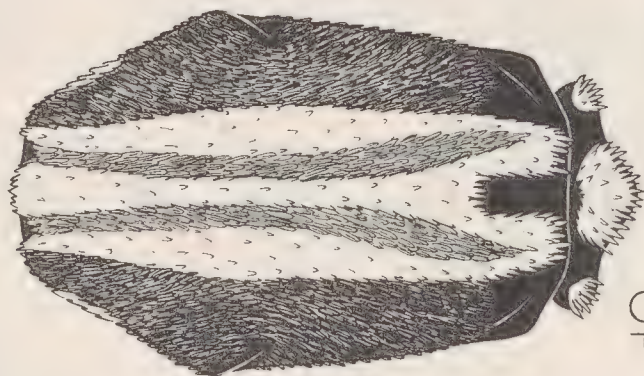
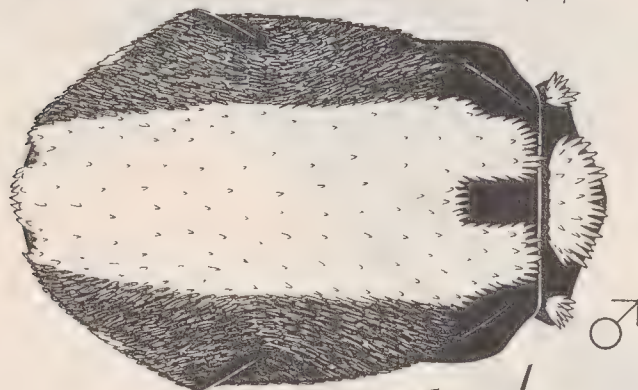
# Fig. 39

## OCHLEROTATUS



BRA 167  
Sao Paulo  
Brazil

1.0



1.0

Mato Grosso  
Brazil

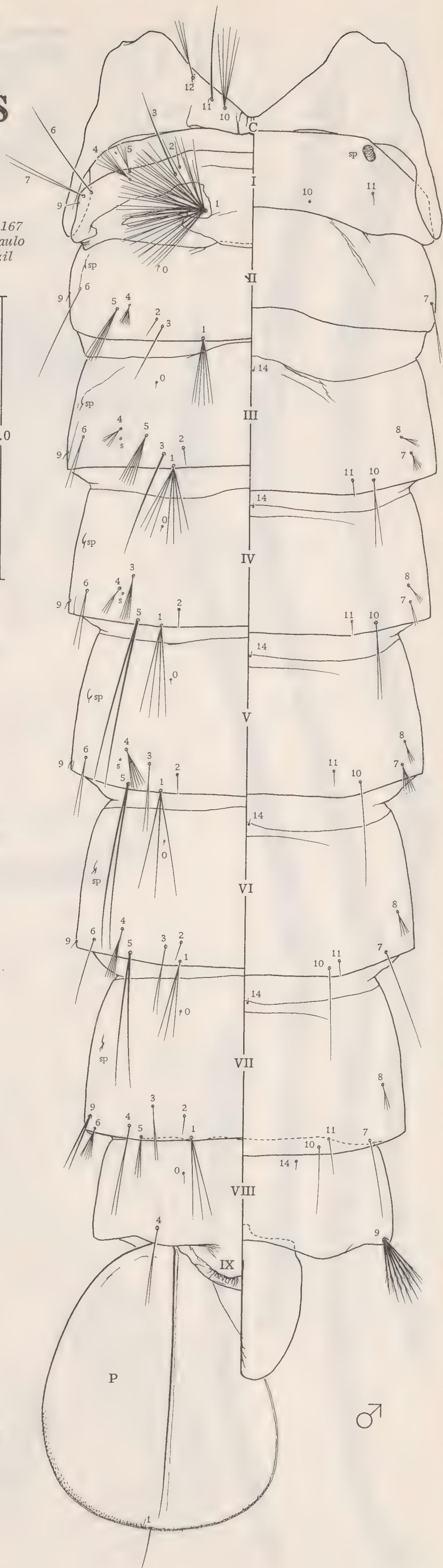


0.3

Sao Paulo  
Brazil

crinifer

LINK



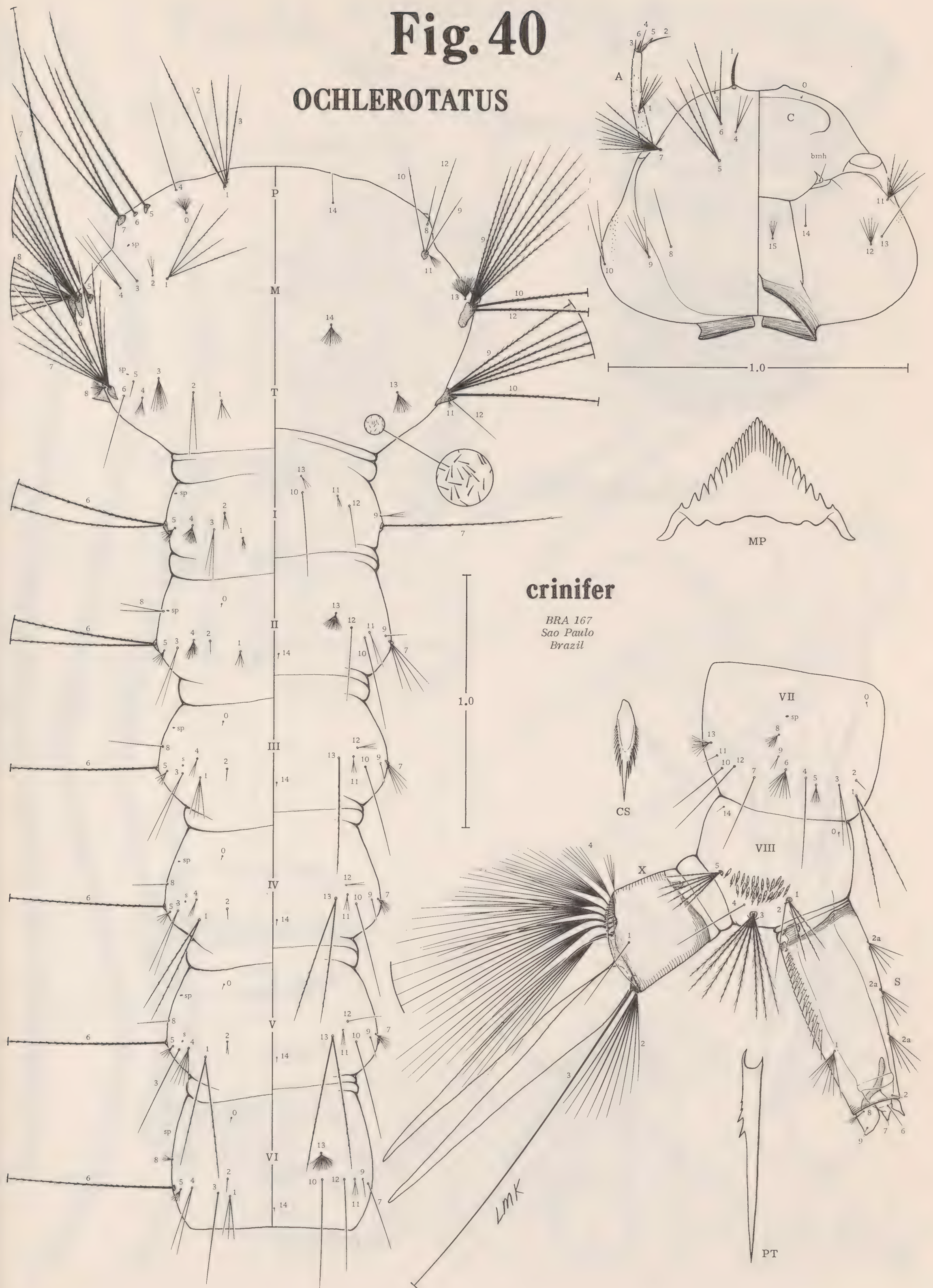
P

♂



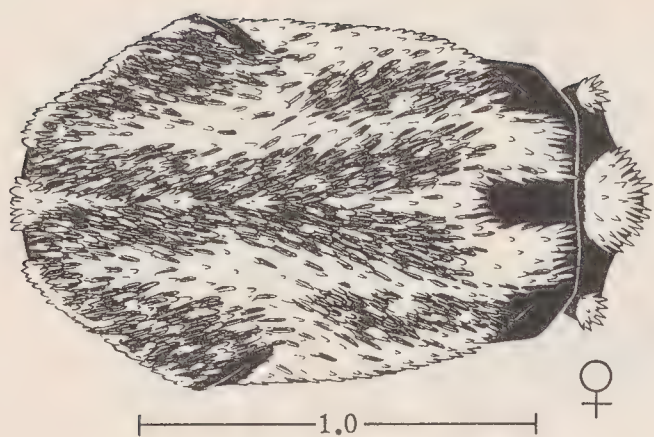
# Fig. 40

## OCHLEROTATUS

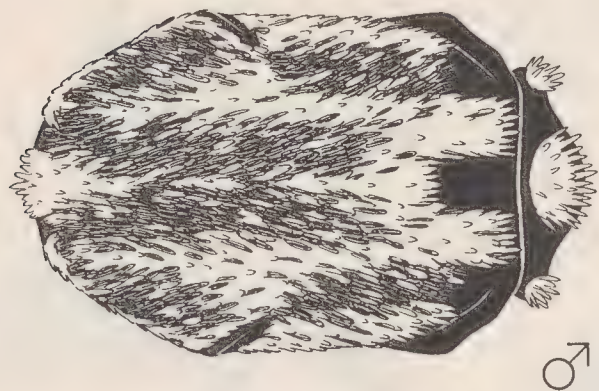




# Fig. 41

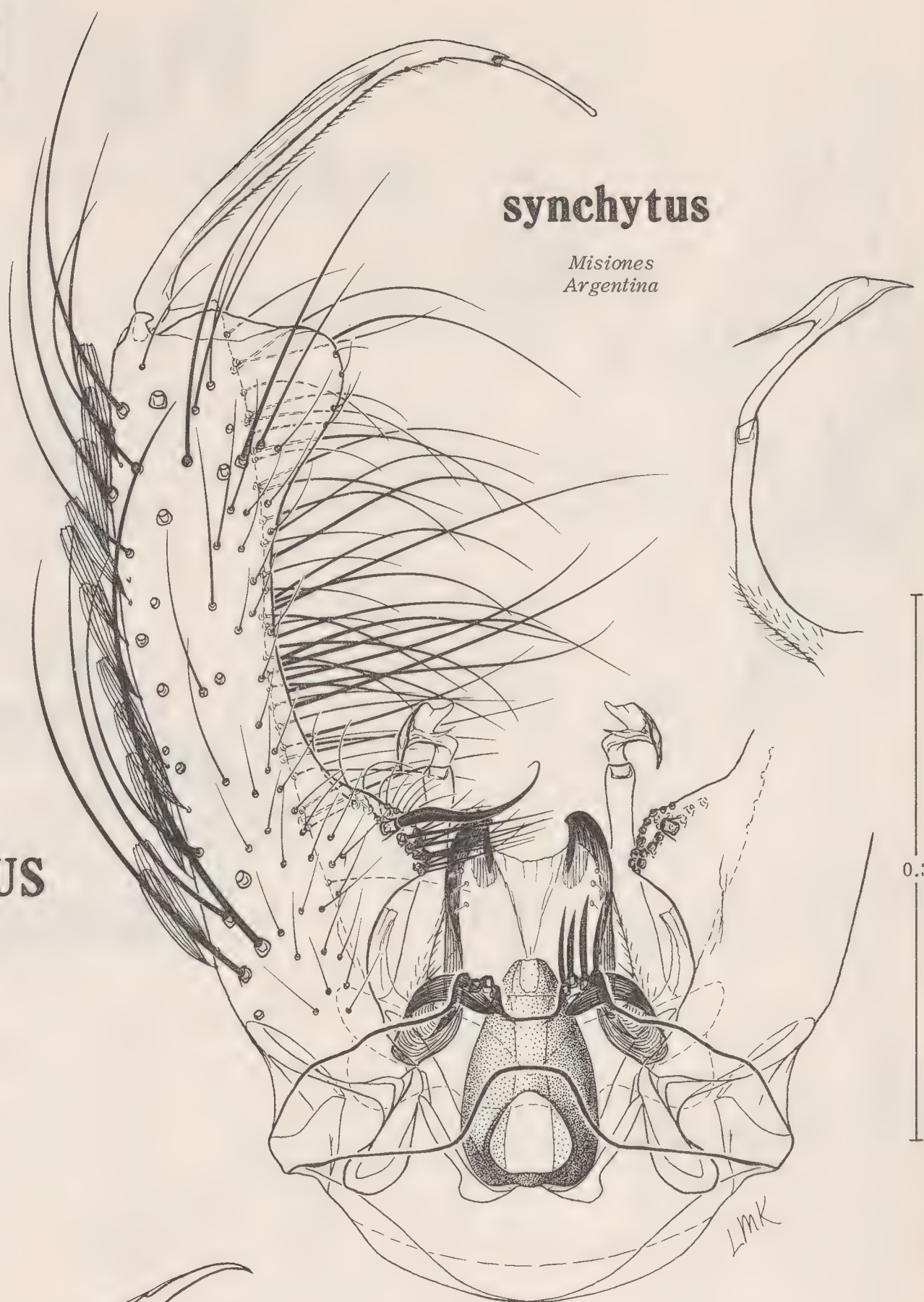


♀



♂

## OCHLEROTATUS

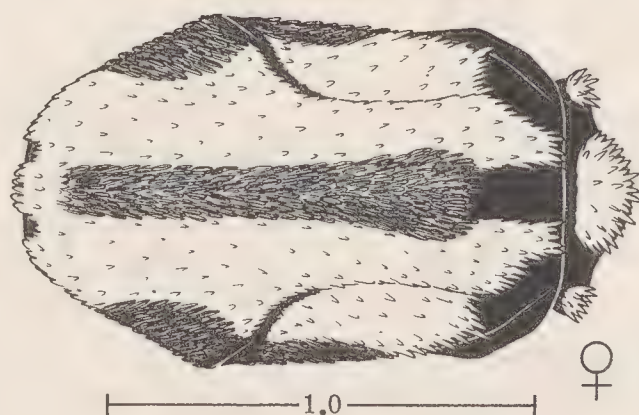


## synchytus

Misiones  
Argentina

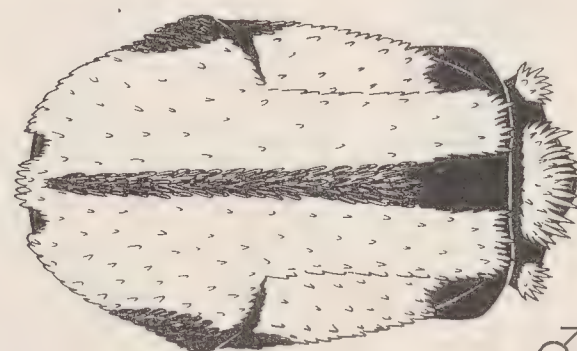


Mona Island  
Puerto Rico



♀

Eleuthera Island  
Bahama Islands



♂

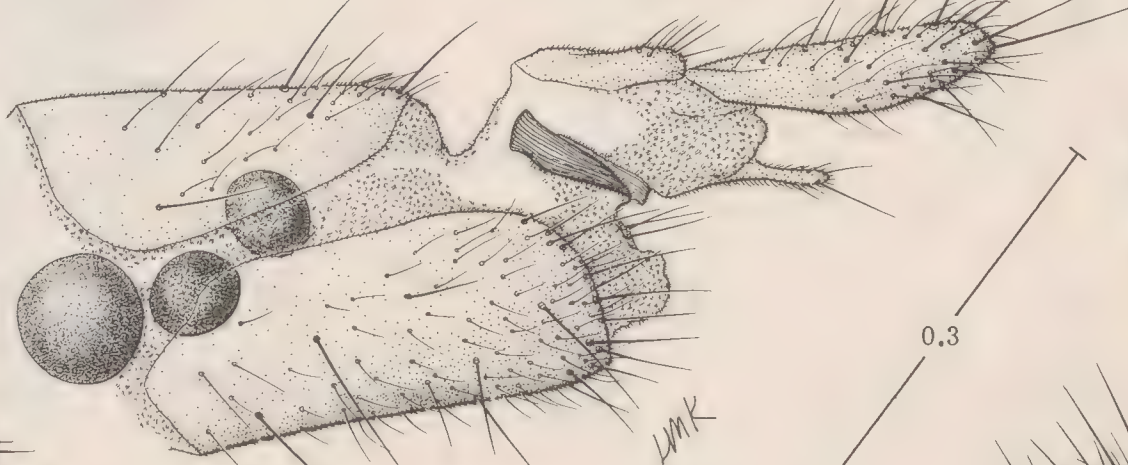
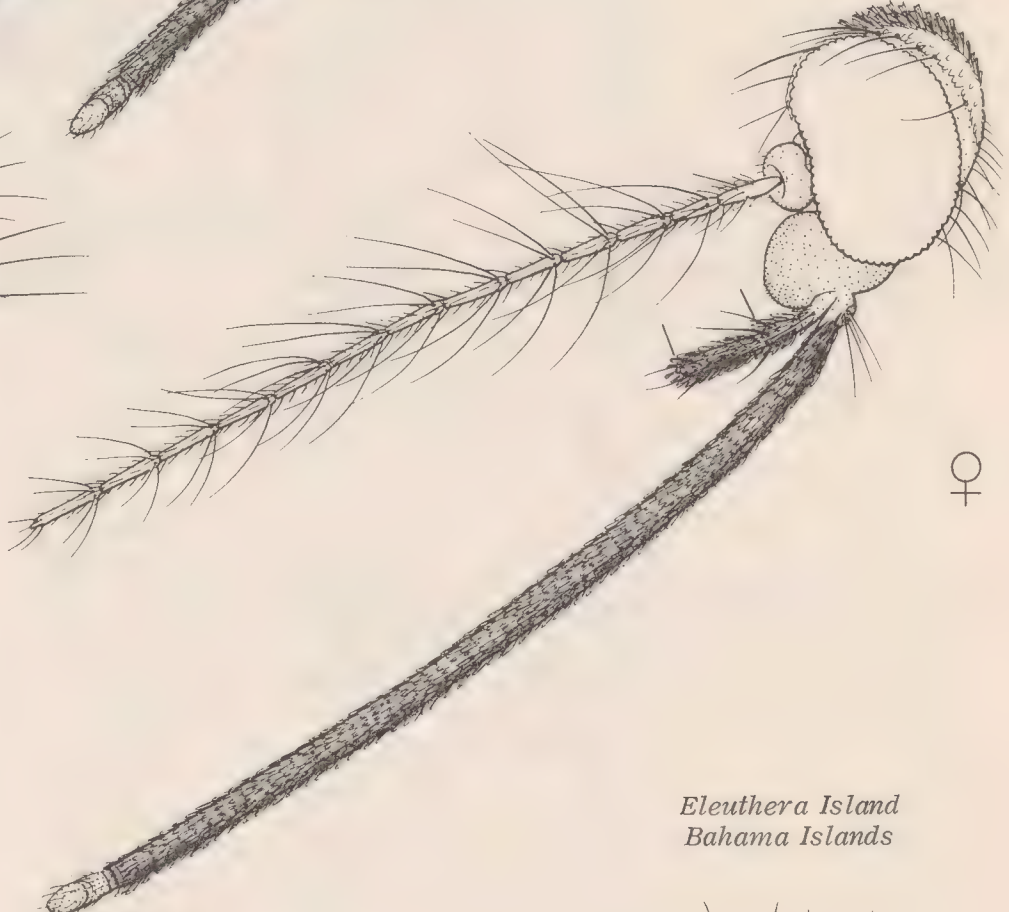
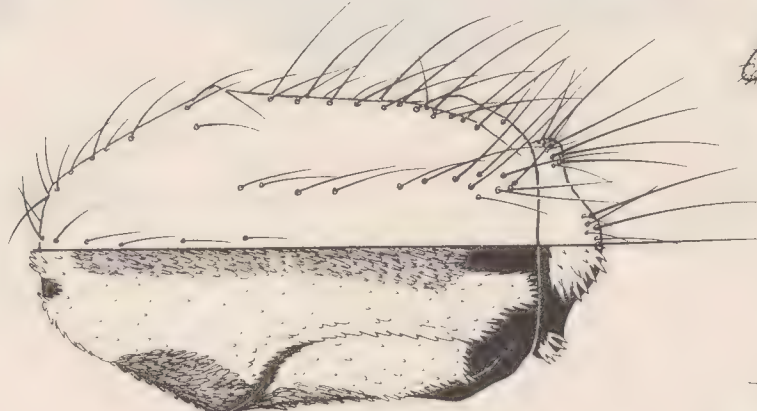
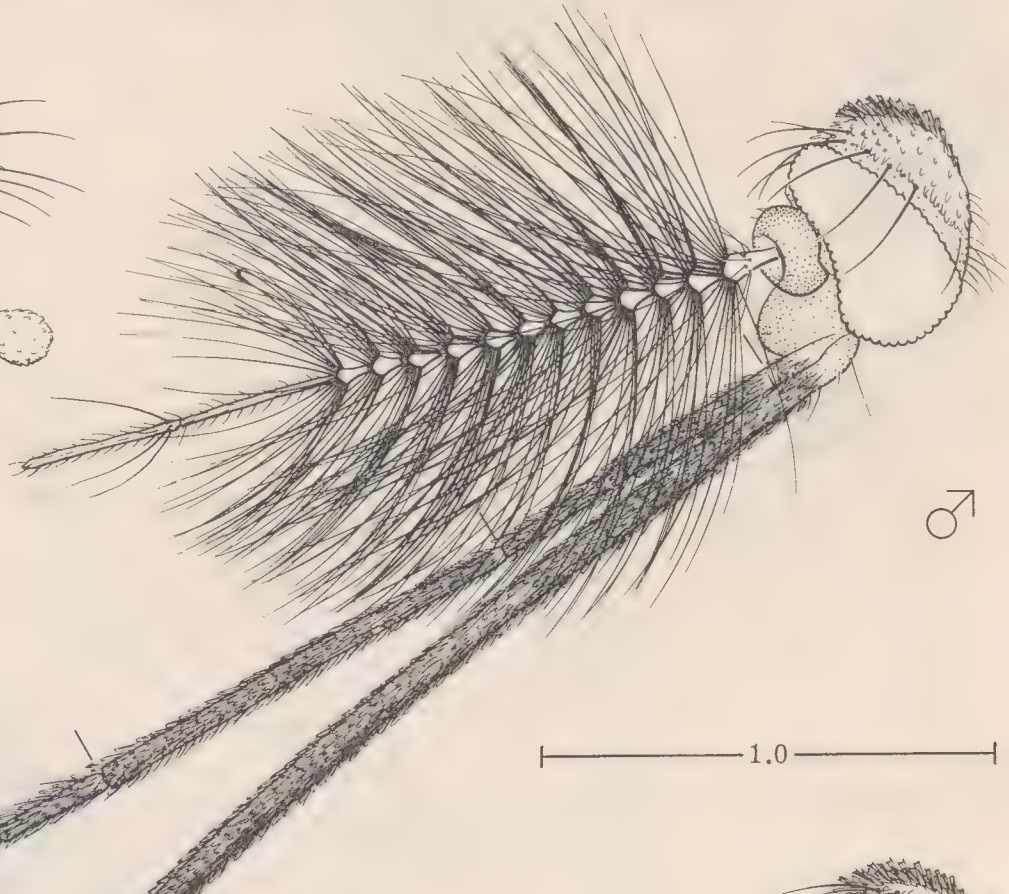
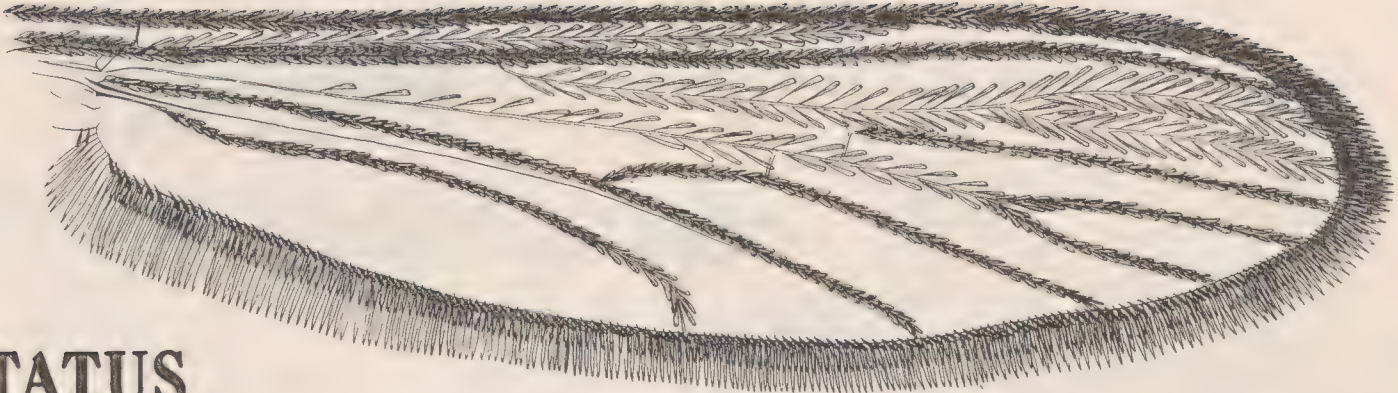
Mona Island  
Puerto Rico

## obturbator



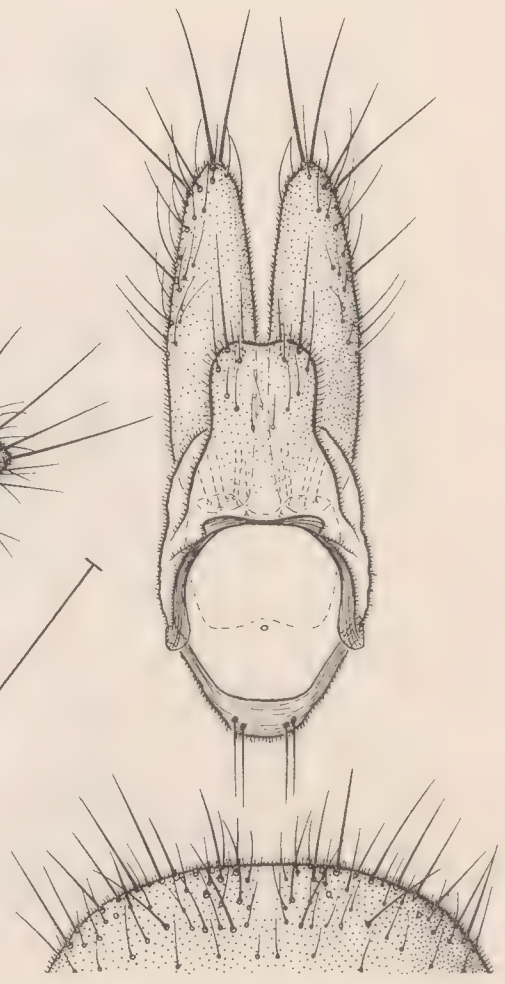
Fig. 42

OCHLEROTATUS



obturbator

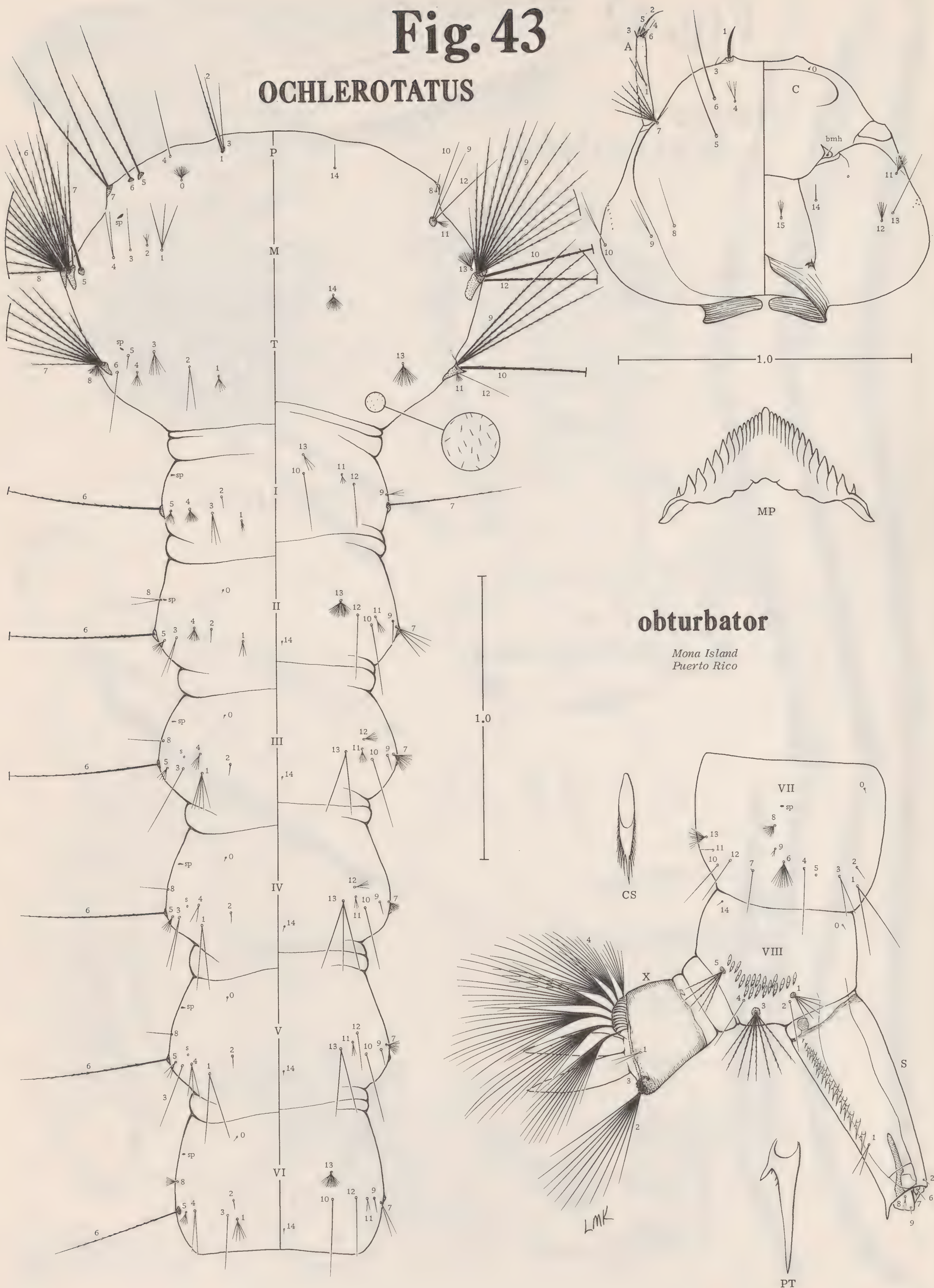
Mona Island  
Puerto Rico





# Fig. 43

## OCHLEROTATUS



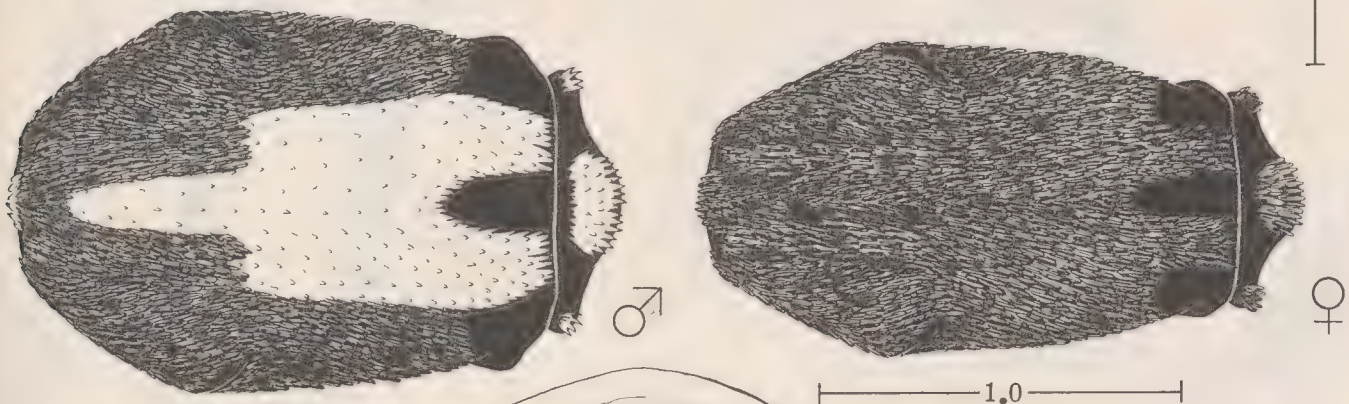
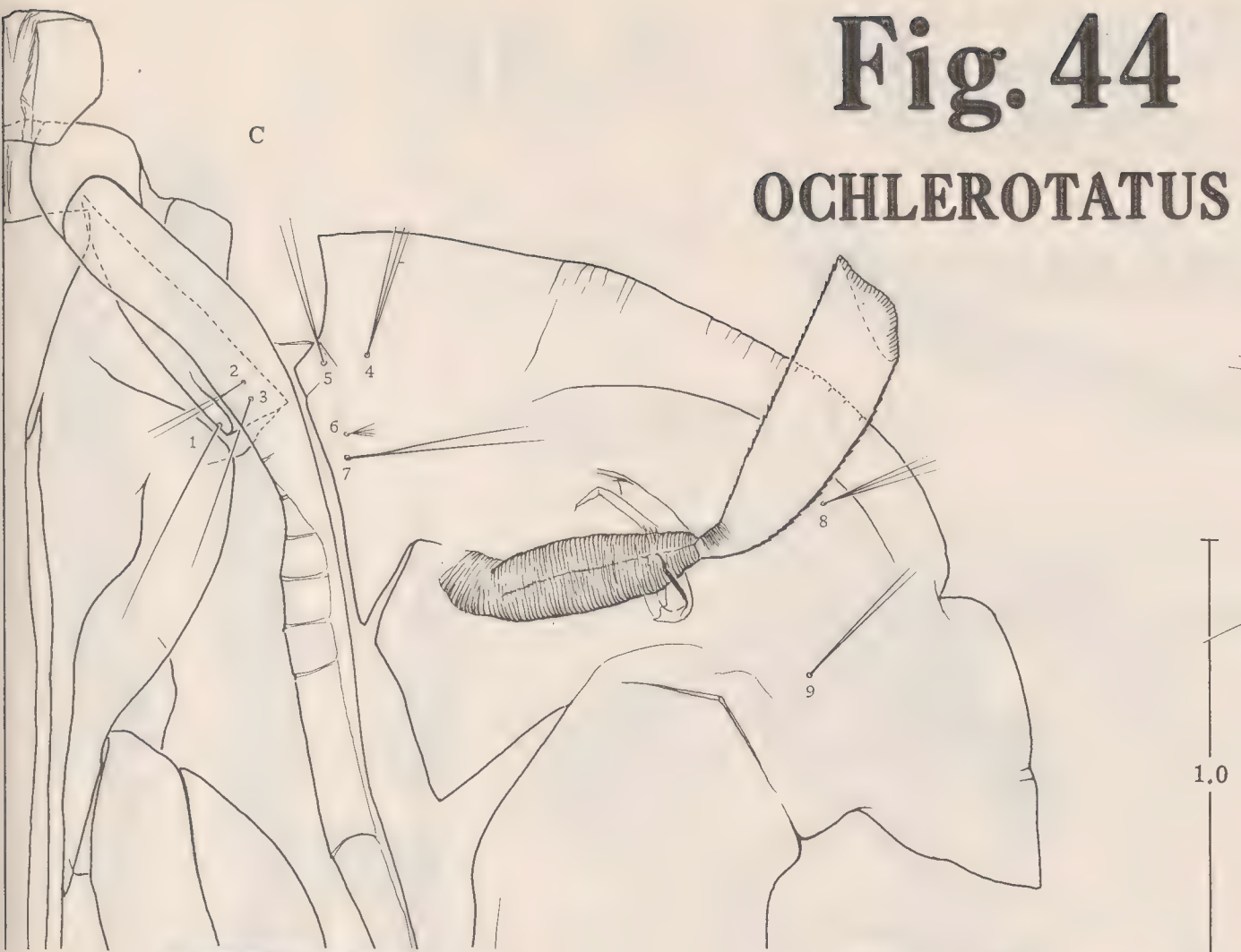
## obturbator

*Mona Island  
Puerto Rico*



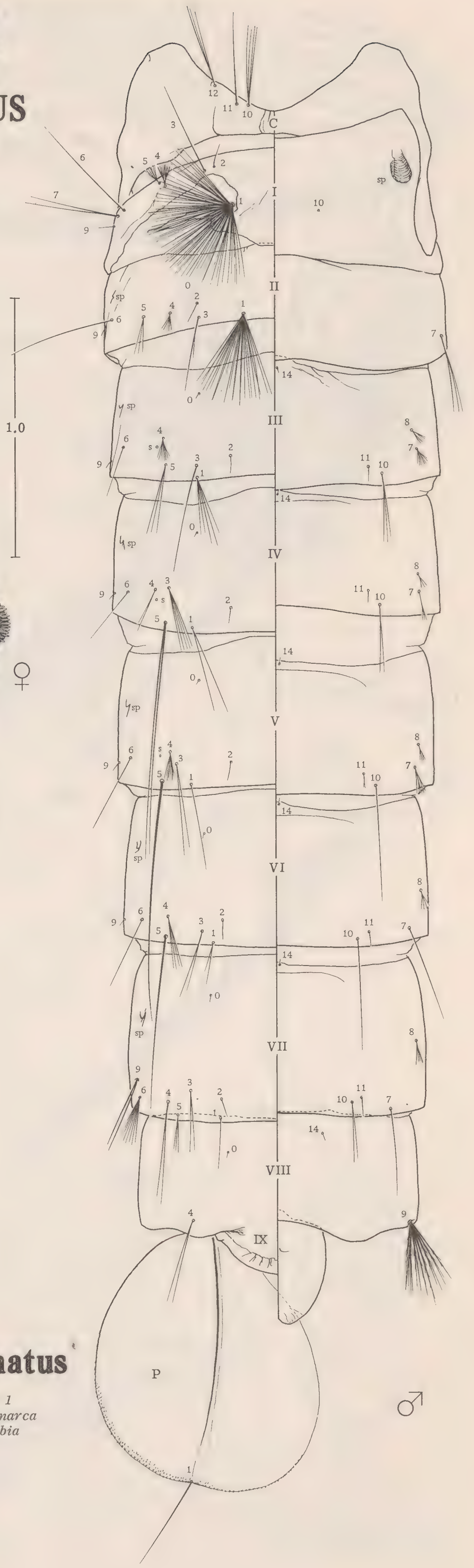
# Fig. 44

## OCHLEROTATUS



**pectinatus**

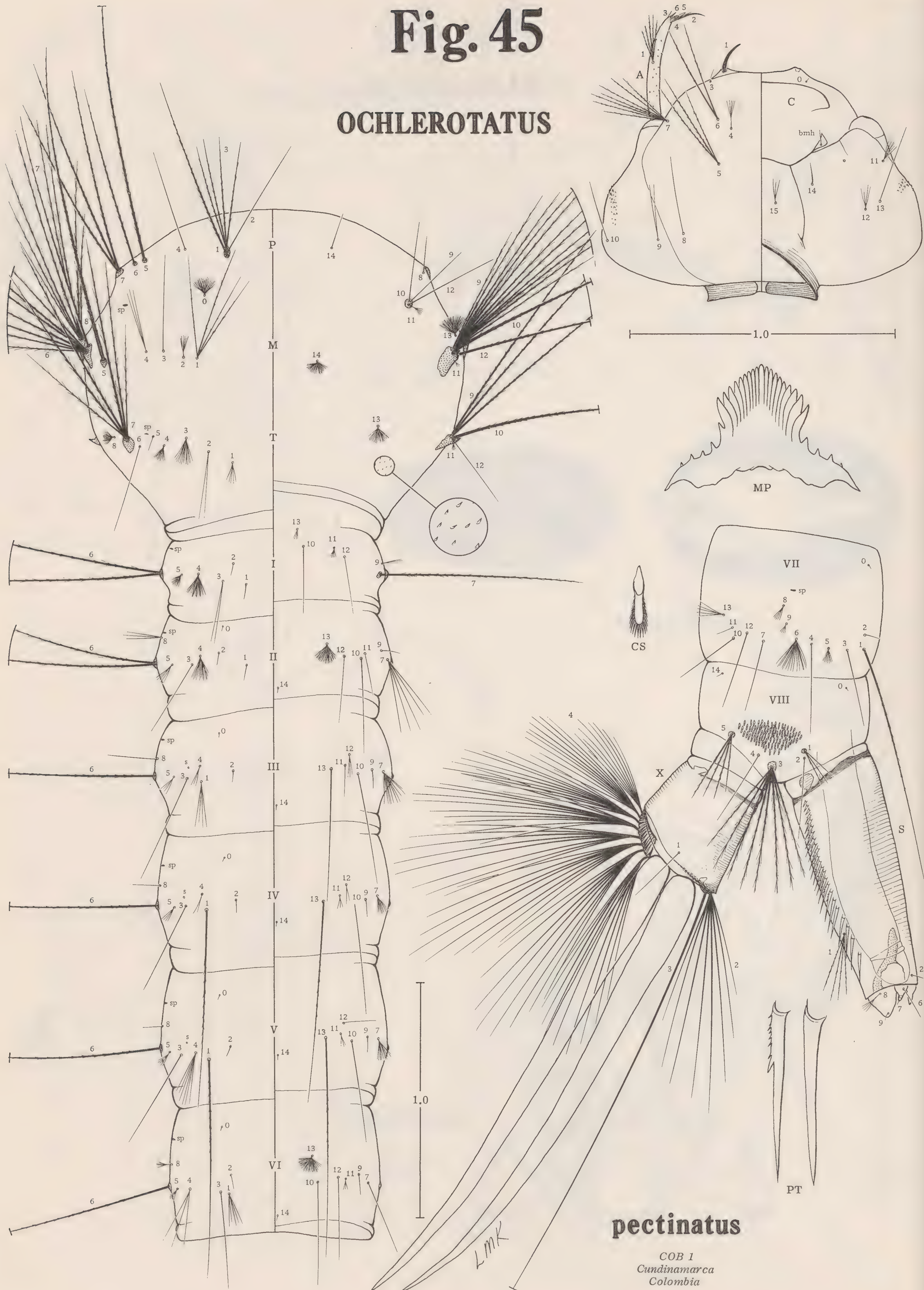
COB 1  
Cundinamarca  
Colombia





# Fig. 45

## OCHLEROTATUS

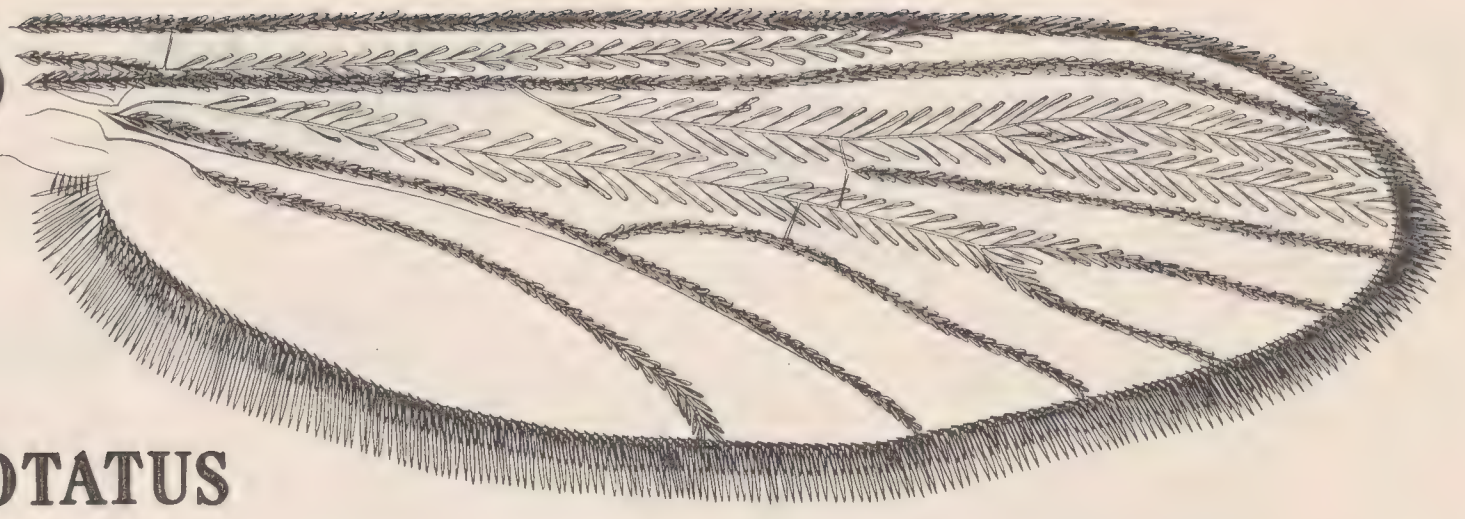




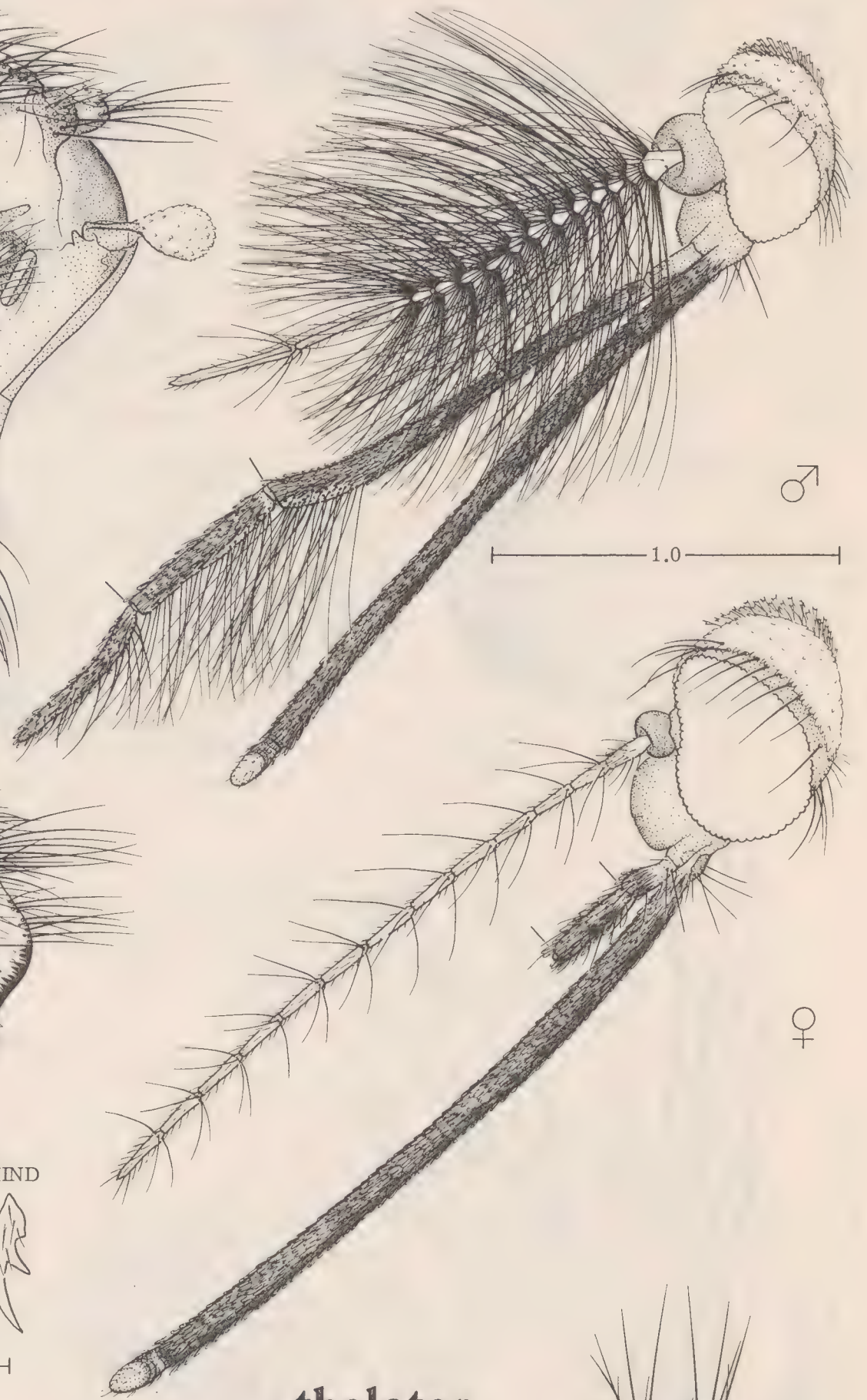
FORE MID HIND

**Fig. 46**

**OCHLEROTATUS**

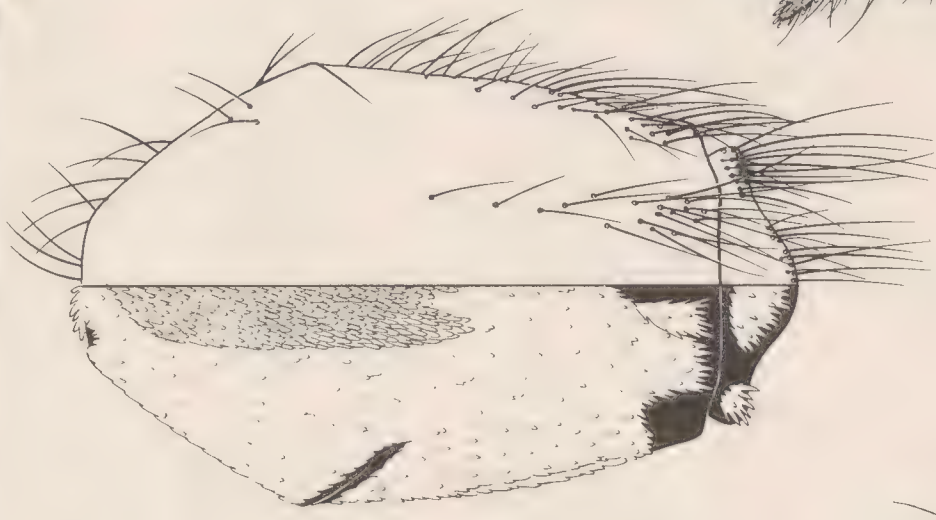


♀



♂

1.0



♀

0.1

♂



FORE



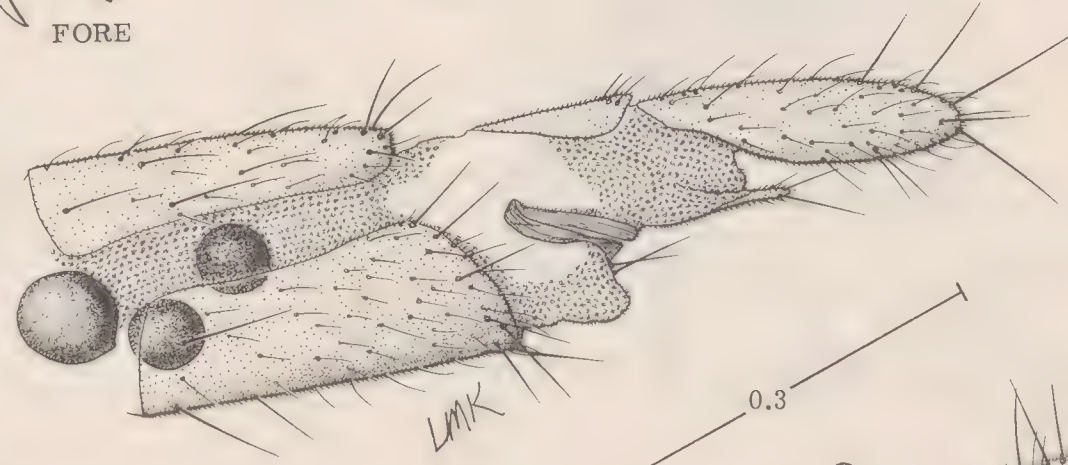
HIND

**thelcter**

Texas  
USA

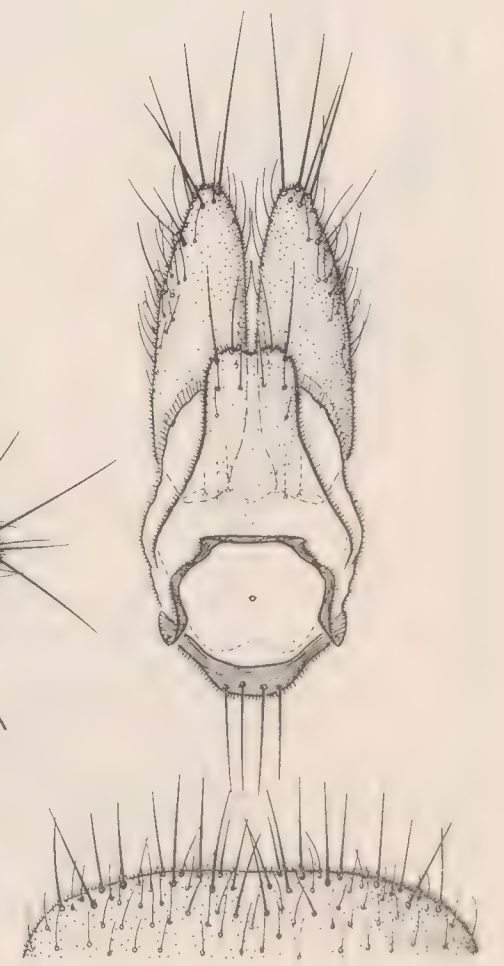


0.1



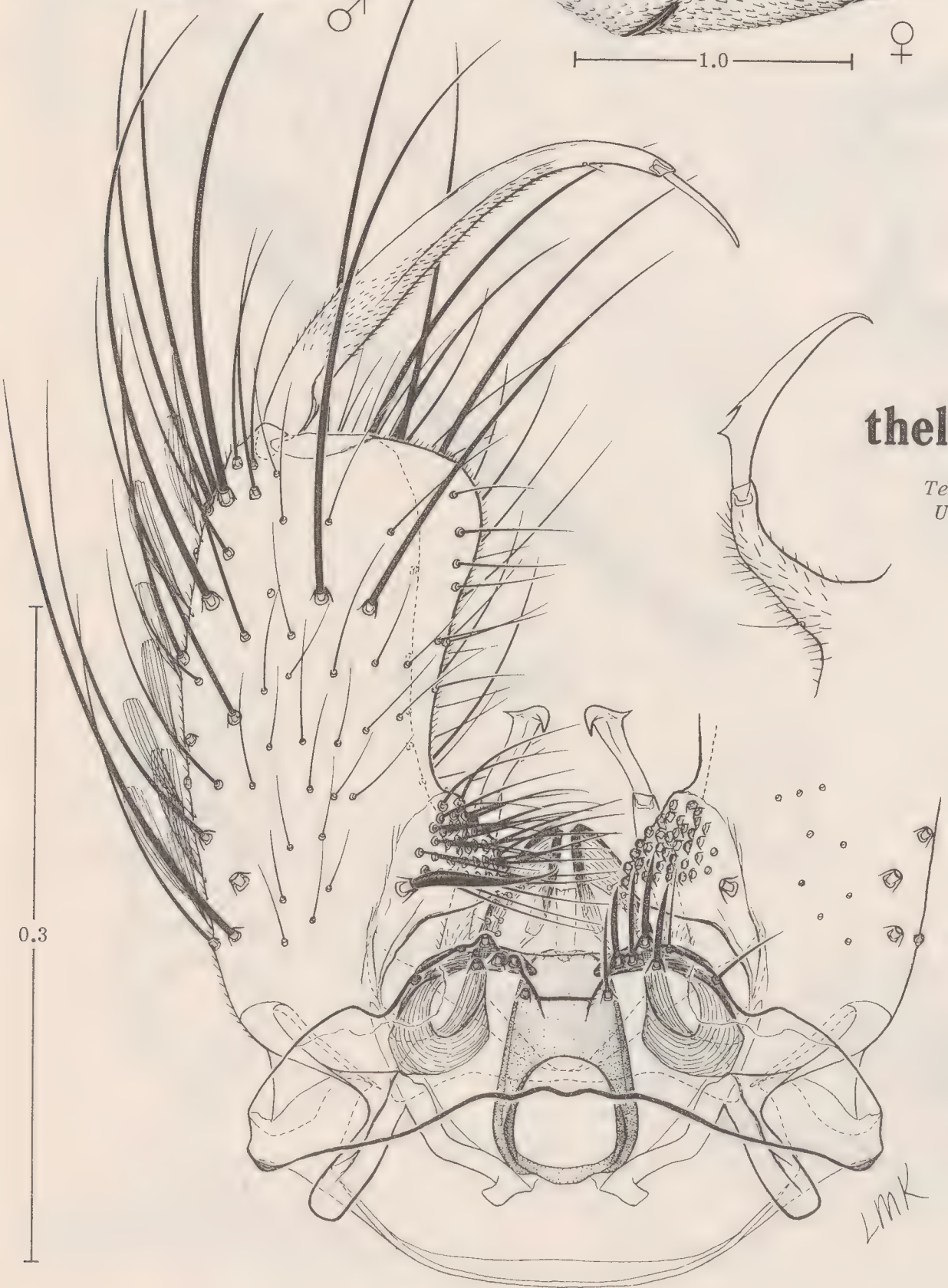
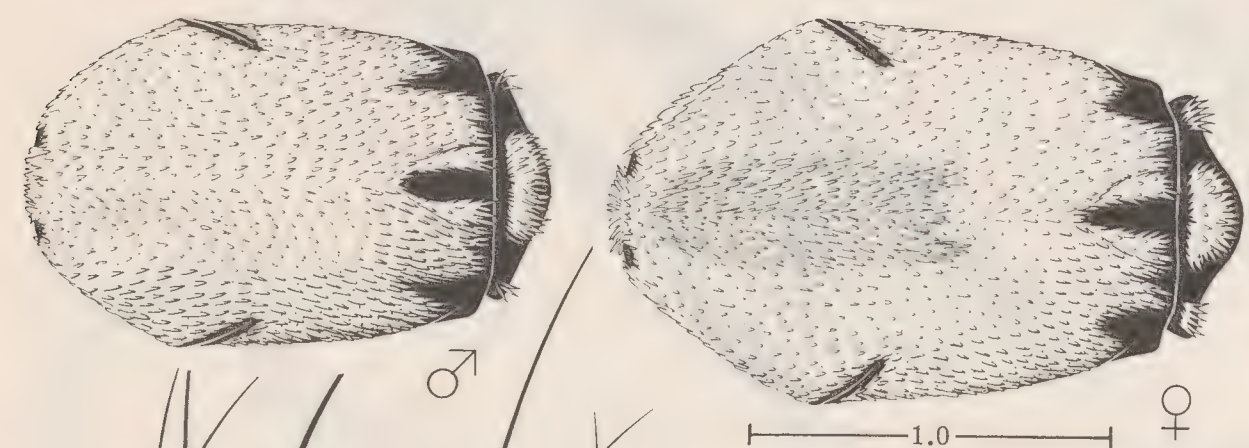
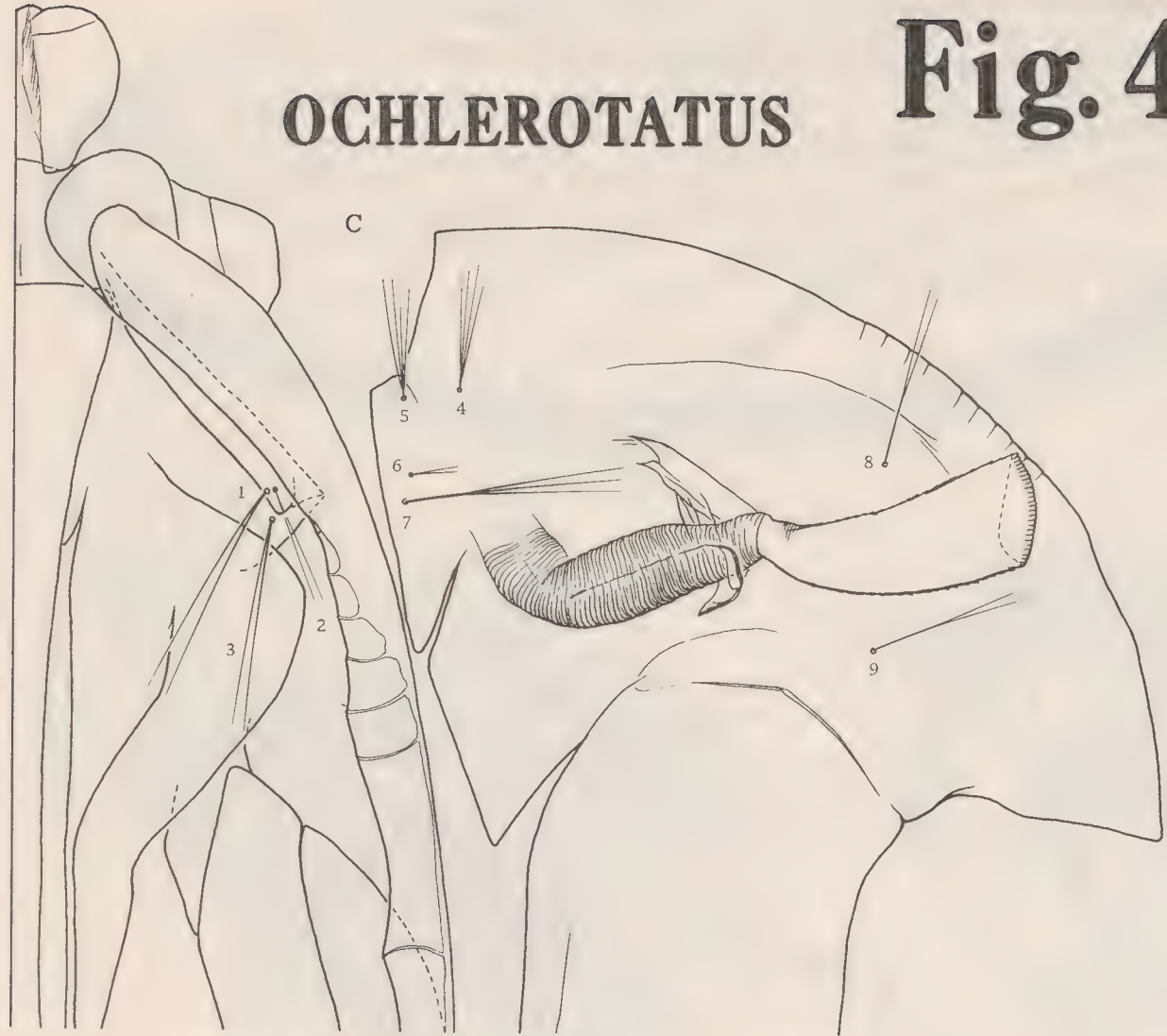
0.3

♀

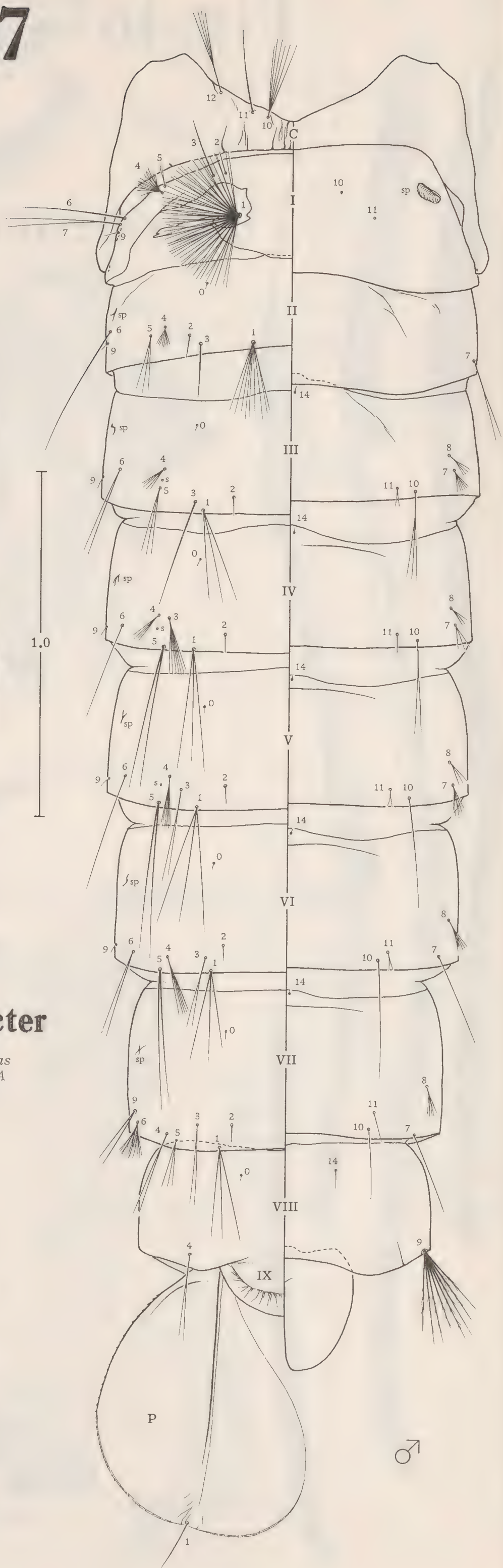




OCHLEROTATUS **Fig. 47**



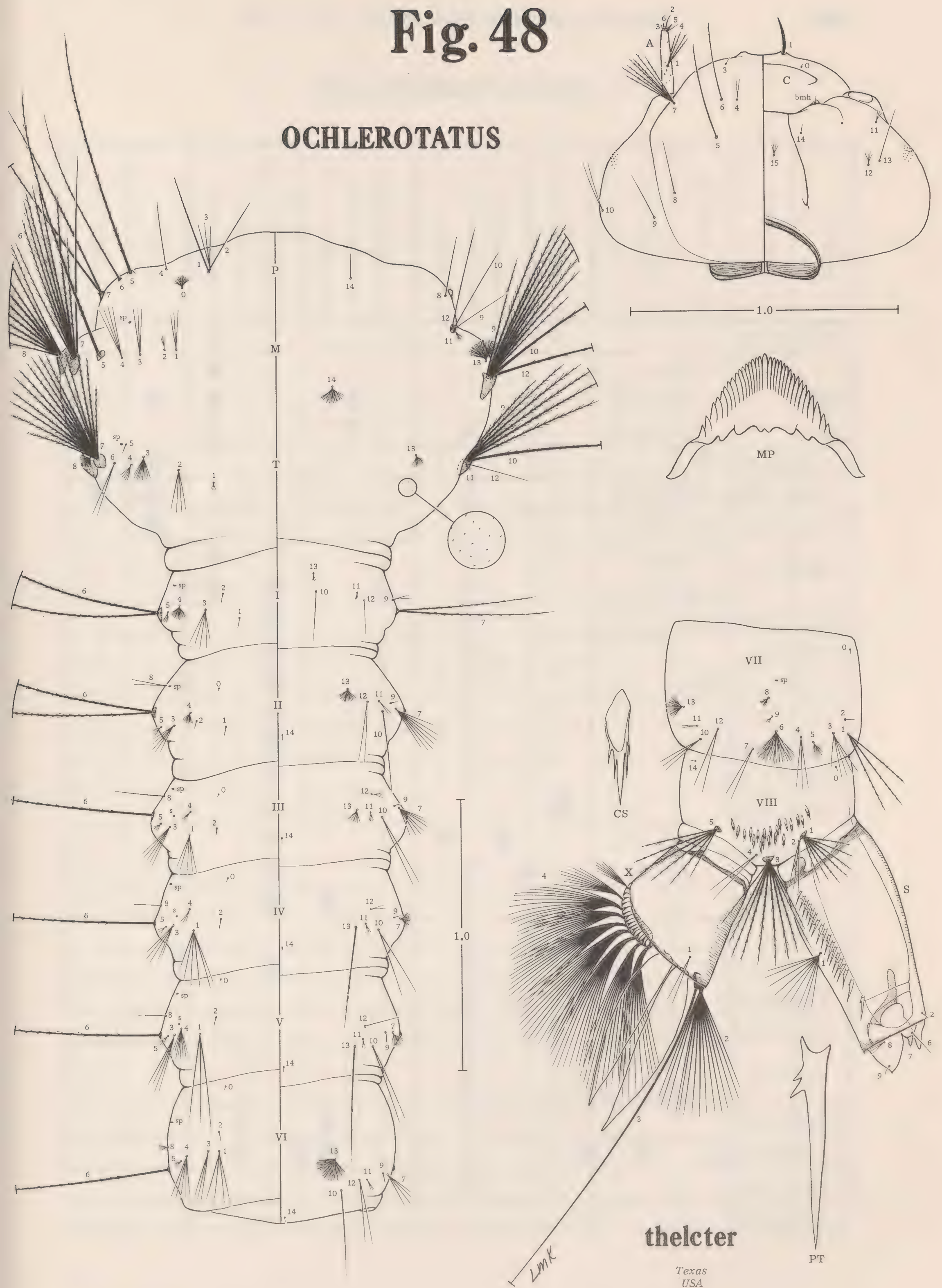
**thelcter**  
Texas  
USA





# Fig. 48

## OCHLEROTATUS





## TABLE OF DISTRIBUTIONS

[illegible]







CONSPECTUS OF TAXONOMIC CHANGES

NEW TAXA

atactavittatus . . . . .	26
bogotanus . . . . .	22
comitatus . . . . .	66
deficiens . . . . .	24
incomptus . . . . .	20
pectinatus . . . . .	74
phaeonotus . . . . .	56
synchytus . . . . .	71

CHANGES IN TAXONOMIC STATUS

<i>camposanus</i> , synonymy . . . . .	57
<i>hemisurus</i> , synonymy . . . . .	57
<i>meprai</i> , to specific rank . . . . .	28
<i>rhyacophilus</i> , synonymy . . . . .	57



## INDEX TO SCIENTIFIC NAMES

- Aedes, 2, 6, 14, 31, 36, 60, 70, 78  
Aedini, 70  
aegypti (Aedes), 50  
aenigmaticus (Aedes), 7  
angustivittatus, 3, 4, 7, 8, 9, 17k, 18k, 20k, 26, 27, 28, 29-34, 37, 67; *figs.* 15, 16  
angustivittatus of authors, 28, 59  
Anopheles, 31, 60, 79  
argentescens, 3, 29, 31, 33  
argyritarsis (Anopheles), 57  
articularis, sp near (Culex), 75  
atactavittatus, 17k, 18k, 19k, 26-28; *figs.* 13, 14; 142  
atlanticus (Aedes), 7  
auratus, 3, 15k, 18k, 19k, 39, 41, 44-46; *figs.* 23, 24  
balteatus, 3, 4, 39, 40, 41, 42  
bejaranoi (Aedes), 7  
bicristatus (Aedes), 70  
bogotanus, 7, 16k, 18k, 19k, 22-24, 25, 36, 41, 47, 49, 51; *figs.* 8-10; 142  
Bogotanus Subgroup, 6, 16k, 22, 79; *fig.* 1  
bracteatus, 3, 4, 39, 40, 41, 42  
brethesi (Culex), 70  
busckii (Aedes), 57  
calumnior (Aedes), 7  
camposanus, 3, 6, 58, 60, 63, 142  
cancer (Deinocerites), 78  
celeste (Haemagogus), 57  
ciliata (Psorophora), 60  
cingulata, sp near (Psorophora), 57  
Colombian form, 16k, 79  
comitatus, 15k, 18k, 19k, 56, 66-67; *fig.* 32; 142  
condolescens, 3, 4, 15k, 18k, 19k, 23, 36, 41, 46-48, 49, 51; *fig.* 24  
condolescens of authors, 40, 59  
confinnis (Psorophora), 78  
confirmatus, 4, 57, 58  
confirmatus of authors, 69  
corniger (Culex), 27  
coronator (Culex), 27  
coronator, sp near (Culex), 70, 75  
crinifer, 3, 4, 14, 17k, 18k, 19k, 68-71, 72; *figs.* 38-40  
crinifer of authors, 51  
Crinifer Subgroup, 6, 16k, 67-68; *fig.* 2  
Culex, 4, 31, 50, 60, 70, 79  
Culex species, 52, 60  
Culicada, 4  
Culicidae, 4  
Culicini, 70  
cuneatus, 3, 4, 29, 31, 33  
cuneatus of authors, 35  
cyanescens (Psorophora), 27, 78  
deficiens, 7, 16k, 17k, 19k, 22, 23, 24-25; *figs.* 11, 12; 142  
discolor (Psorophora), 78  
dolosa of authors, 69, 70  
dorsalis (Aedes), 78  
dupreei (Aedes), 4, 7, 70  
eucephalaesus (Aedes), 7  
euiris (Aedes), 4, 7  
euiris, sp near (Aedes), 24  
euplocamus, 4, 15k, 18k, 20k, 23, 36, 41, 46, 47, 48-50, 51, 52, 58, 67; *figs.* 25, 26  
euplocamus of authors, 58, 59  
evansae (Anopheles), 70  
ferox (Psorophora), 27, 52  
fluviatilis (Aedes), 75  
habanicus, 3, 39, 40, 42  
habilitator (Culex), 41  
hastatus (Aedes), 7  
hemisurus, 6, 58, 60, 142  
Heteronycha, 4  
hortator (Aedes), 4  
iguazu, 68, 69, 70  
incomptus, 16k, 18k, 19k, 20-22, 79; *figs.* 5-7; 142  
Incomptus Subgroup, 6, 16k, 20; *fig.* 1  
inconspicuus, 3, 4, 35, 38  
indolescens, 3, 58, 63  
infirmatus, 4, 7, 8, 9, 15k, 18k, 19k, 36, 46, 48, 53-55; *figs.* 29-31  
infirmatus of authors, 35  
Infirmatus Subgroup, 6, 15k, 46, 54; *fig.* 3  
ioliota (Aedes), 57  
jocasta (Culex), 57  
jubifer, sp near (Culex), 22  
keyensis, 76  
Leucomyia, 4  
lynchii, 68, 70  
magnus (Deinocerites), 41  
meprai, 17k, 19k, 26, 28; *fig.* 32; 142



- milleri (Aedes), 7, 25  
 nigripalpus (Culex), 27  
 nubilus (Aedes), 7  
**obturbator**, 3, 4, 7, 16k, 17k, 19k, 26, 72-74; *figs. 41-43*  
**Obturbator Subgroup**, 6, 16k, 72; *fig. 2*  
 Ochlerotatus, 2, 4, 5, 6, 7  
 oligopistus (Aedes), 7  
**patersoni**, 15k, 18k, 20k, 23, 36, 41, 46, 47, 48, 49, 50-52; *figs. 27, 28*  
**pectinatus**, 7, 14, 16k, 17k, 19k, 74-75; *figs. 44, 45; 142*  
**Pectinatus Subgroup**, 6, 16k, 74, *fig. 1*  
 pertinax (Aedes), 7  
**phaeonotus**, 15k, 18k, 20k, 56-57, 59; *figs. 33, 34; 142*  
 pilosus (Culex), 27, 70  
**plutocraticus**, 3, 4, 39, 40, 41, 42  
*Protoculex*, 7  
*Pseudohowardina*, 4  
 Psorophora, 31, 60, 78  
 Psorophora species, 22, 60  
 quinquefasciatus (Culex), 31  
**raymondi**, 3, 15k, 17k, 19k, 46, 52; *fig. 32*  
**rhyacophilus**, 6, 58, 60, 142  
 Sabethes, 9  
 Sabethini, 70  
**scapularis**, 2, 4, 6, 7, 9, 15k, 18k, 20k, 27, 36, 47, 52, 56, 57-66, 67, 72; *figs. 35-37*  
*scapularis* of authors, 48  
**Scapularis Group**, 2, 3, 4, 5, 6, 7, 9-14, 21, 23, 25, 27, 30, 36, 45, 47, 49, 51, 54, 57, 59, 60, 61, 67, 69, 70, 71, 72, 73, 74, 75, 77, 79  
**Scapularis Subgroup**, 6, 15k, 55-56, 57, 67; *fig. 4*  
 scutellalbum (Aedes), 7, 75  
 serratus (Aedes), 4, 7, 9  
 Serratus Group (Aedes), 7  
 shannoni (Aedes), 6, 7  
 signipennis (Psorophora), 78  
 sollicitans (Aedes), 78  
 splendens (Haemagogus), 57  
 sticticus (Aedes), 37  
**Surinam form**, 16k, 78-79; *fig. 1*  
**synchytus**, 17k, 18k, 19k, 68, 70, 71-72; *fig. 41; 142*  
 Tamarix, 77  
*tapinops*, 68, 70  
**thelcter**, 3, 7, 8, 9, 14, 16k, 17k, 19k, 36, 76-78; *figs. 46-48*  
**Thelcter Subgroup**, 6, 16k, 76; *fig. 1*  
 titillans (Mansonia), 31  
 tormentor (Aedes), 7  
**tortilis**, 3, 4, 15k, 18k, 19k, 23, 36, 39-44, 45, 47, 49, 51, 60; *figs. 20-22*  
*tortilis* of authors, 45  
**Tortilis Subgroup**, 6, 15k, 38-39; *fig. 1*  
*traversus*, 3, 29, 34  
 trichurus (Aedes), 70  
*trivittata* of authors, 35  
**trivittatus**, 3, 4, 7, 8, 9, 17k, 18k, 20k, 23, 26, 27, 28, 30, 31, 35-38, 41, 47, 49, 51, 54, 73; *figs. 17-19*  
*trivittatus* of authors, 29  
**Trivittatus Subgroup**, 6, 16k, 25-26, 27, 46, 54; *fig. 2*  
 Uranotaenia, 50, 60, 79  
 Uranotaenia species, 24  
 vexans (Aedes), 37, 78  
*virginensis*, 3, 39, 40, 41, 44